DIMENSIONS OF SOCIAL CAPITAL
AMONG HIGH SCHOOL MATHEMATICS TEACHERS

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by

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DIMENSIONS OF SOCIAL CAPITAL AMONG HIGH SCHOOL MATHEMATICS TEACHERS (261 pp.)

This study sought to uncover teacher perceptions of social capital within a high school mathematics department utilizing a research design that acknowledged the complex environment faced by high school teachers and their subsequent interpretations of how and from whom they sought access to professional resources. Through an analysis of narratives captured as teachers interviewed one another in strong-tie pairs, the study identified the elements of social capital which were central to the professional lives of high school mathematics teachers. Narrative analysis revealed that the group, situated in an urban setting, was able to define issues around trust and structure within their network. There was significantly less discussion or acknowledgement of the remaining dimensions of social capital: level of professional expertise within their group, and the depth or content of their professional interactions. Teachers had no vocabulary, interactional routines, norms or other tools to assist in the analysis of these key social capital resources.

The study found that there is a need for an additional dimension to be included in existing social capital models. Defined as “Group Self-Knowledge”, I describe this construct as a way for teacher networks to detect, define and assess their own capacity for change and innovation. The ability of a network to assess its social capital is described as
necessary in determining specific needs for professional development resources, and in aligning those needs with the resources (physical, human or social capital) that are most likely to lead to conditions in which a network could learn, adapt, grow and change.

Social capital models offer constructs which can assist in social capital analysis, and which could lead to significant impacts on educational organizations: a “systems” view that privileges the knowledge of the group and disrupts teachers’ tendency towards individualism, presentism and conservatism (Lortie, 1975); an expectation of professionalism, creativity and problem-solving from the teachers within the system; a shift away from a deficit model of teaching towards a vision of educational systems as collections of assets; and an educational model that operates from a standpoint of reinvestment and re-cycling of vital resources back into itself.
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CHAPTER I
INTRODUCTION

Background of the Research Problem

In the current school reform environment, high schools and high school teachers are featured prominently. Many large-scale efforts to change the quality of high school students’ learning are underway, with supporting large-scale funds (e.g., High Schools That Work; Talent Development High School Model; Small Schools Initiative; First Things First Initiative; Gates Foundation’s Early College High School Initiative, Schools for a New Society, Coalition of Essential Schools). The focus of reform has been on high schools in the past decade due to their stubborn resistance to change, their distinctive bureaucratic and departmental features, and their prominence within the K-12 educational system (Grossman, Wineburg, & Woolworth, 2001; McLaughlin & Talbert, 2001; Sizer, 1984; Supovitz & Weinbaum, 2008). Educational innovations such as the creation of teacher professional learning communities, the hiring of math coaches to enhance mathematics content learning, and distributed teacher leadership, which have been successful in many K-8 settings at establishing a sustainable infrastructure for instructional improvement, have proven much more difficult to implement and maintain at the high school level (McLaughlin & Talbert, 2001). Mathematics instruction, in particular, has been under scrutiny for its adherence to traditional, teacher-centered
models of knowledge transmission which limit opportunities for student inquiry (Jerald, 2006; Mullis, Martin, Gonzalez, & Chrostowski, 2004).

In the spring of 2010, a federally-funded mathematics project grant was awarded to co-principal investigators at a large mid-western state university in order to impact student learning via directed and intensive work with teachers around their own mathematical thinking, sense-making and understanding. One of the four larger goals of the study was to create sustainable and supportive teacher learning communities in order to impact student learning through teacher learning in ways that have been successful in other educational settings. However, there was a question as to how to adapt those learning community structures to the environment of an urban U.S. high school. Where Coburn & Russell (2008) had found “access to expertise” (i.e., a skilled cadre of math “coaches”) an important aspect for reform among elementary school teachers, the nature of high schools and high school mathematics teaching does not invite inclusion of these types of content experts (Brown et al., 2007). Likewise, other studies of change initiatives within mathematics teaching have found that teacher communication was “deepened” when district resources were aligned to focus on student sense-making and inquiry in mathematics (Fennema et al., 1996; Franke, Carpenter, Levi, & Fennema, 2001; Kazemi & Franke, 2004; Stein, Engle, Smith, & Hughes, 2008; Stein & Coburn, 2008), however, these encouraging results have occurred almost exclusively in K-8 settings. Mathematics teachers in U.S. high schools have resisted deep changes both in their curriculum choices and in their pedagogical approaches (McLaughlin & Talbert, 2001; Little, 2002; Sizer, 1984). Departmental specialization within U.S. high schools has
resulted in more intense hierarchical status relationships between teachers, increased teacher isolation, and a teaching culture that discourages the sharing of professional knowledge (Goodson, 2001; Grossman et al., 2001; Little, 2002; McLaughlin & Talbert, 2001; Rousseau, 2004; Siskin & Little, 1995).

One aspect of schools that contributes to a resistance to change (Cuban, 1990) is the complexity of the environment (Davis & Simmt, 2003; Lampert, 2002; St. Julien, 2005). Teachers must constantly negotiate and maintain teaching and learning spaces in minute-to-minute decisions (Schoenfeld, 2008) that are based on a multitude of intertwined factors. As central hubs in the system, teachers are in the unique position of having to balance the forces of internal system elements (students, peer teachers, administrators, and interactions between these groups and individuals) and external stakeholders (national and state testing, parent concerns, administrative and district initiatives, and educational mandates) (Goodson, 2001; Hoban, 2002).

The teachers in this study, like those in high schools across the country, make choices daily based on multiple interpretations of value, perceived utility, and usefulness towards achieving their own teaching and learning goals. These choices are inevitably shaped by the culture within which they operate – the dominant culture that defines a majority of high schools in the U.S. -- as well as their own unique school culture, which both shapes and is shaped by the teachers, students, community and administrators who encompass it (Cortazzi, 1993). The high school in the study -- large, urban, serving many disadvantaged students -- was part of a district characterized as one of the lowest
performers in the state on measures of student achievement (student tests in grades 3-8 and grade 10, graduation rates, and attendance rates). The district’s state “Report Card Ranking” stood at “Academic Watch”, only a few points away from the lowest rank of “Academic Emergency.” Teachers there felt intense pressure from politicians, administrators, students and parents as they negotiated and examined their teaching practice.

In this study, the co-principal investigators (of a federally-funded project) and I (as a project research assistant) were allowed access for three years to a group of high school teachers who were working on increasing student achievement through multiple district- and building-level change initiatives. Using the Yale/New Haven Professional Development Model (Yale University, 2012) and the Focus on Mathematics (Boston University, 2012) professional development models, the original project was focused on impacting student achievement through increasing teacher content knowledge, increasing pedagogical content knowledge, and increasing the quality of the time they spent on collaborative work. This work, ultimately, involved teacher beliefs about learning, about their students, and about mathematics. The project began with, and often revisited, salient resources (technology, instructional practices, and curriculum resources) identified by the teacher participants as being of the most use to them. As the project work progressed, often discussed were questions of teacher motivation and teacher beliefs. What instructional practices might meet these teachers’ needs? What resources could we access that might assist these teachers as they worked to improve their own and their students’ understanding of mathematics? How could we, as “participant-observers”
(Spradley, 1980), as researchers both “inside” and “outside” of teachers’ educational lives (Cochran-Smith & Lytle, 1993), create trust within this group, yet continue to push on their as-yet unexamined ways of thinking about mathematics content and pedagogy (Ball & Cohen, 1999)? Our discussions around these types of questions, along with consideration of district- and building-mandated initiatives, allowed my own dissertation study to emerge and evolve throughout the year.

My own questions, embedded within the larger project, focused on the group as a community, both as a departmental community, and as a part of their larger school-based community. Many recent large-scale reform efforts include the formation of “professional learning communities” as explicit goals, and there is now a rich literature base which highlights both the potential rewards of such structures for professional growth (Graham, 2007; Hipp, Huffman, Pancake, & Olivier, 2008; Hofman & Dijkstra, 2010; Horn, 2005; Kazemi & Franke, 2004; Lachance & Confrey, 2003) as well as warnings about their potential pitfalls (Achinstein, 2002; Hargreaves, 1991; Hargreaves, 2010). My early questions concerned high school teacher perceptions about themselves as learners of mathematics, and how these perceptions fit with the newer, often imposed (Hargreaves, 2010), notions of “communities of learners.” What social and organizational differences are present between secondary and elementary communities that might point to explanations of why adapting successful K-8 professional learning strategies to the high school is so difficult?
Table 1 demonstrates that this dissertation study, although overlapping in some areas with the original project (which funded the professional development for the teachers throughout the year) and the preliminary study conducted by me, was presented as a separate research project with a different focus from the project which funded teacher participation in targeted professional development.

Table 1: Relationship of Dissertation Study to Project and Preliminary Study

<table>
<thead>
<tr>
<th></th>
<th>Purpose</th>
<th>Research Questions/Objectives</th>
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<tr>
<td>West High/Midwest State Mathematics Project</td>
<td>Increasing student achievement and teacher quality through professional development with mathematics educators and mathematician</td>
<td>Increase teacher content knowledge, increase pedagogical content knowledge, align curriculum with standards, and increase the quality of the time spent on collaborative work</td>
<td>Learning Mathematics for Teaching; Reformed Teaching Observation Protocol; Wilder Survey; OGT results; teacher reflections</td>
<td>West High Mathematics Department (14 teachers)</td>
<td>Spring 2010 – Summer 2011</td>
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<tr>
<td>Koebley Preliminary Study</td>
<td>Preliminary research around a HS mathematics teacher learning community</td>
<td>How do West HS math teachers see themselves as a group? How did these perceptions change as teachers spent more time in collaborative work?</td>
<td>Observations and recordings of teacher meetings; teacher written reflections; informal interviews</td>
<td>West High Mathematics Department (14 teachers)</td>
<td>Winter – Spring 2011</td>
</tr>
<tr>
<td>Koebley Dissertation Study</td>
<td>Focused research around HS math teacher perceptions and definitions of “social capital”</td>
<td>What elements of high school mathematics teachers’ social environment do high school teachers see as affording or constraining their ability to improve instruction? How does participation in a collaborative planning and peer observation teaching cycle impact views of social capital?</td>
<td>Recordings of teacher interviews (teachers in pairs discussing what resources and expertise consider important as they examine their own practice); Teacher information about whom they consult for advice; Reflections from teachers; Data from preliminary study</td>
<td>West High Mathematics Department (14 teachers)</td>
<td>Summer – Fall 2011</td>
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My questions about teaching assumptions and the high school setting led to more fine-grained deliberations about how high school mathematics teachers might perceive their own efforts at improving or changing their professional practice. One lens through which to view such questions is that of social capital. Social capital is defined as the resources that are made available to agents within a system by virtue of the strength of a social network (Burt, 2001). Inclusion and participation in these social groups affords greater access to resources for the individual members (Bourdieu, 1977), facilitates
coordinated action between its members (via norms and cultural agreement) (Coleman, 1988), and results in “the achievement of certain ends that would not be attainable in its absence.” (Coleman, 1988, p. 97). Social capital, then, is an accumulation of the features and constructs of social organization that allow maximum benefits (for the group and for its members) to be realized via the collective efforts of individuals in a group. In other words, “better connected people enjoy higher returns” (Burt, 2001, p 32), and it is teachers’ access to valuable resources and expertise, embedded within social networks, which enable them “make use of resources to effect change” (Penuel, Piel, Krause, & Frank, 2009, p. 124).

The social capital viewpoint takes into account the organizational and structural affordances and constraints of high school teachers (schedules, departmental hierarchies, etc). But, how is one to access these perceptions and definitions of social capital? One related and significant study (Coburn and Russell, 2008) analyzed four dimensions of social capital among mathematics teachers who were implementing inquiry-focused instructional programs. The research sought to uncover how policy and administrative supportive structures translated to district-level success in realizing the benefits of large-scale reform. The four dimensions of social capital defined by the researchers focused on teacher relationships with one another, with teacher leaders, and with the curriculum. These constructs of social capital were instructive for the school structures at the elementary and middle school levels (the focus of the study), but are these same dimensions salient at the high school level? Or are there other dimensions of teacher social capital that may be present among high school teachers but have been as yet
unexamined? What resources do high school teachers seek out through their professional/social connections as they examine their own instructional practice? For example, what happens to the construct of “access to expertise” at the high school level, where math coaches are rare, and where questions of subject-matter expertise are central to their professional identity (Siskin & Little, 1995)?

In a review of sociological research on the underlying causes of social movements, or large-scale societal change events, McAdam (2003) outlined the limitations of focusing only on “structural” notions to explain why social movements have been able to take form, mobilize and lead to paradigmatic changes. Without paying heed to cultural realities of the system being examined, the results of any study will necessarily be limited by the “hoary problem of sampling on the dependent variable” (McAdam, 2003, p. 286) – examining structures for causality after a defining event has already occurred. To see a more representative picture, he claimed, research methods need to focus on the cultural context of networks with an “insider view” that pays credence to culture as defined by the participants themselves; “the obvious need for thick ethnographic descriptions of movement processes”, as well as not ignoring “the methodological riches inherent in the various forms of conversational and discourse analysis” (McAdam, 2003, p. 297). This study sought to uncover teacher perceptions of social capital at the high school level, within a mathematics department, and through a research design that acknowledged the complex environment faced by high school teachers and their subsequent interpretations of how and from whom they sought access to professional resources.
This study, then, arose out of a year-long immersion with a group of high school mathematics teachers who were involved in a grant-supported initiative aimed at improving student achievement in a high-needs district through examination of their instructional practice. As much of the project work occurred with teachers in community with one another, questions arose as to what resources teachers could access through peer collaboration in order to support their professional learning. What resources (if any) does collaborative planning, teaching and peer observation afford teachers as they focus on improving their mathematics content and pedagogical knowledge? What aspects of teachers’ “social capital” are afforded or constrained within the traditional organizational structures of an American high school when viewed through the eyes of the teachers as they collectively examine their practice?

**Theoretical Orientation**

This study approached questions of teacher social capital through a social organizational perspective (Rosensholtz, 1989) wherein shared assumptions and beliefs about appropriate practice are seen as impacted by (and in turn, have an impact on) the organizational structures, policies and traditions in which they are embedded. Through this sociological lens, collective meanings were seen as conveyed through and shaped by ongoing communication and observations between members of the group, and teacher behavior as modified or transformed through new shared interpretations of the nature of their work. Teachers were seen as knowledge-generators (Cochran-Smith & Lytle, 1993) within this system as they interacted with one another and within the boundaries of their organizational environment (Rosensholtz, 1989). The dimensions of teacher social
capital, viewed socio-culturally and through a “communities of practice” lens (Lave & Wenger, 1991), are bound contextually within the organizationally- and socially-constructed definitions (Clandinin & Connelly, 1996; Rosensholtz, 1989) of teachers’ department, school, district, and community environments. Framed in terms of my dissertation study, this research examined what teachers considered to be valuable dimensions of social capital (resources, expertise and social ties) as they sought to improve their professional practice.

Access to these ideas can occur through the study of teacher narratives (Bruner, 1986), in which the “collective character of the knowledge system” (Davis & Simmt, 2003) reveals itself, along with the elements of that system which teachers feel are the most relevant. Teacher community (the social environment comprised of the teachers, their interactions with one another, and the content of these interactions) was viewed as the primary conduit for the expression of social meaning, a place where exchange of resources both shaped the collective group identity and was, in turn, shaped by it (Cortazzi, 1993). Thus, viewing teachers as “scholars of their own consciousness” (Dewey, 1938/1997), I sought to uncover possible additional dimensions of teacher social capital at the high school level through the stories of the teachers who lived them. Teacher knowledge was in this manner was held central to the research process, and teacher expressions of this knowledge as the primary method of access.
Statement of the Problem and Research Questions

In this study, I was interested in learning more about high school mathematics teachers’ conceptions of social capital from their vantage point and in terms of their lived experiences. How did high school mathematics teachers think about and approach improving their teaching practice, and what resources do they access as they do so? What resources (if any) did collaborative planning, teaching and peer observation afford teachers as they focused on improving their mathematics content and pedagogical knowledge? What aspects of teachers’ “social capital” were present within the American high school when viewed through the eyes of the teachers as they collectively examined their practice?

The study examined the following questions:

1. What elements of high school mathematics teachers’ social environment do high school teachers see as affording or constraining their ability to improve instruction?
2. How do high school mathematics teachers define the dimensions of their own social capital?
3. How does participation in a collaborative planning and peer observation teaching cycle impact individual and collective views of social capital within a high school mathematics department?

Operational Definitions

Social Environment – the elements related to a teacher’s work environment which impact interactions within their school-based professional community, including peer teachers
and administrators, as well as the organizational structures of the school itself (structure of the school day, hierarchies of expertise and authority, and physical layout of the work environment) (Rosensholtz, 1989; Sizer, 1984; Supovitz & Weinbaum, 2008).

Social Capital – resources and expertise accessed through social channels that allow for greater productivity and individual growth -- “the goodwill available to individuals or groups (whose) source lies in the structure and content of the actor's social relations (and which impacts) the information, influence, and solidarity it makes available to the actor” (Adler & Kwon, 2002, p. 23).

Community – a group or collective that shares common interests, convenes and operates around common goals, and engages in collaborative work around questions generated from within the group itself for the purpose of individual and collective reflection towards improving professional practice (Little, 2003; Wenger, 1998).

Teacher Networks – a social structure that can be defined, operationalized, visualized, and statistically analyzed using constructs such as “tie strength” (level and depth of information shared between network members, types of communication shared), “tie length” (closeness between network members, both in physical proximity and in degree of trust), number of members, and how groups of members “cluster” or disperse (Adams, 2000; McAdam, 2003). Network analysis identifies key “actors” or “nodes”, which consist of the individual group members who make up the network, and “connectors”, or the ties and their characteristics (how close the members are professionally, how often and about what they communicate) which create associations or links between
individuals in the network (Wellman & Wortley, 1990; Adler & Kwon, 2003). The terms “actor” and “node” are used interchangeably in this study, with “node” being used most often to indicate points on a social network graph, representative of real-life “actors” or individuals who participate in school communities.

**Summary**

With an intense focus on high schools and high school teaching, often from sources and authorities outside of the high school culture itself, it is of utmost importance that teacher interpretations of the resources they need to improve their practice are identified and considered. This study examined the narratives and professional knowledge gained by teachers who had completed an intensive year of focused professional development, including collaborative planning and peer observation of a research lesson. Through analysis of the teacher reactions and stories around this and other professional experiences, elements of social capital unique to high school mathematics teachers were identified. Knowledge of what resources teachers value as they are examining and trying to improve their practice should be of interest to administrators, teacher educators, professional developers, or others who make policy decisions around teacher professionalism and teacher accountability.
CHAPTER II

REVIEW OF THE LITERATURE

A review of the literature on structures in U.S. high schools is presented here, as well as relevant background research about teachers’ lives, high school teaching, and some of the specific challenges of teaching high school mathematics. A review of models for teacher professional growth follows, with a focus on professional learning communities and their history and emergence as an important vehicle for teacher learning. Finally, I summarize definitions and background research on notions of social capital and how they have been applied in educational settings.

High Schools, High School Teaching, and Mathematics

The Structure of American High Schools

High school structures in the U.S. have remained relatively unchanged for over 100 years (Cuban, 1988; Siskin & Little, 1995). At the turn of the last century, the United States was in the midst of recovering from its civil war, changing economically through industrialization, and looking for political security through relations with the powerhouses of Europe. Schools and models for teaching reflected this move towards “modernism.” Conditions of teaching at the time were impacted by the need for the quick recruitment of large numbers of teachers due to the advent of free public schools, the subsequent reliance on the textbook by teachers who lacked sufficient training, and top-down decisions made by administrators in efforts to direct school development
High schools were thus set up to emulate successful industrial factory models of output, with authoritarian lines of command, tight control of time during the day, and strict adherence to criteria set by experts outside of the school environment (Siskin & Little, 1995).

These early authoritarian models have proven resilient over time, with overly rigid school structures, entrenched teacher beliefs, and poorly executed reform implementations as descriptive today as they were the last century (Cuban, 1988; Siskin & Little, 1995). Sizer’s (1984) description of the high school work environment is all too familiar:

…a rushed procession of 52-minute classes, the jumble of ‘subjects’, none either thoroughly defined or related to any other, leaving even the ablest and most devoted students in a swamp of intellectual confusion; the predominance of teacher-talk and student-listen, with its attendant docility; the reduction of the goals for a school to the collection of credits (meaning ‘seat time’); and the procession of mindless, brief tests that relate little, if at all, to the curriculum the students have supposedly traversed (Sizer, 1984, p. x).

Sizer’s work with multiple high schools revealed a pattern of teachers’ compromising of student learning expectations and resistance to changing teaching approaches due to short class periods, an emphasis on gaining credits and short-term test scores, and a lack of authority over what is taught and how to teach it in their classrooms.
Results from U.S. high schools and national testing reflect persistent underachievement: in 2005, only 68% of students graduated within 4 years, only 57% had taken the recommended core academic courses, and, while scores of K-8 students have steadily improved, the math and reading scores of 17-year-olds have not increased in over 40 years (Jerald, 2006).

With knowledge of these issues, and speculation as to the causes of problems in high schools, efforts at reform aimed at high schools have intensified over the past decade. Sizer’s Coalition for Effective Schools, intended to reduce prohibitive structures that block teacher and student creativity (Sizer, 1984), was one of several large high school reform programs to receive funding from the Gates Foundation. Other programs, including High Schools That Work, the Talent Development High School Model, Small Schools Initiative, First Things First Initiative, Gates Foundation’s Early College High School Initiative, and Schools for a New Society (Stayton, 2006), focused on improving a high school model that is “obsolete” (Gates, 2006) by increasing rigor in academic subjects for students, the quality of relationships between adults and students in school, and relevance of the material learned as connected to the work they will do when they graduate (Stayton, 2006). In July of 2010, Secretary of Education Arne Duncan outlined the challenges surrounding high school reform, including three myths that challenge and often stand in the way: that setting higher standards will lead to more drop-outs due to students’ inability to learn; poverty is destiny among our neediest students; and standards for college readiness are too elusive for teachers and students to meet (Duncan, 2010). Despite positive results at some sites (Bloom, Thompson, & Unterman, 2010), the Gates
have admitted that they were unprepared for the difficulties in changing high school structure and culture, concluding that it is easier to start new schools than to change existing high schools (Greene & Symonds, 2006). Recently, the Gates Foundation decided to redirect funding from high school reform to changing education policy around such matters as seniority and teacher accountability, stating (to some) the obvious: “We’ve learned that school-level investments aren’t enough to drive systemic changes” (Dillon, 2011).

In a large scale study of five high school reform programs funded by the U.S. Department of Education, Supovitz & Weinbaum (2008) and colleagues found that variability of implementation is not the exception in such projects, but the rule. Their team found differences in how high schools first interpreted the reform programs with which they were engaged, but also recognized variability in how the reform initiatives changed the sites themselves, thus leading to evolving and differing iterations levels of implementation. Describing this process as “iterative refraction” (p. 153), the researchers paid close attention to the roles that district leaders and building leaders played in the implementation, viewing them as essential components of successful projects. For central office staff, questions of how the district goals matched the reform goals were found to be salient, as well as commitment to supplying the physical and human resources to support the reform, and aligning district vision statements and priorities for all actors at all levels within the impacted system. For building leaders, the research pointed to the importance of supporting their faculties as they worked to change their approaches to teaching, including creating new communication and leadership patterns.
among building networks, creating high expectation in the building, expecting accountability, and providing incentives for staff who participate. Of note in the study is the importance of informal leaders among teacher groups, pointing to the potential of reworking traditional high school departmental and leadership structures. Other studies have expanded on the importance of building and district leadership, highlighting the inability of teacher leaders to effect change when administrative practices did not allow them the freedom needed to impact teaching of others in their group or department (Scribner & Bradley-Levine, 2010).

The importance of considering departmental structure as central to any understanding of the nature of high schools and high school teaching has been recognized only recently, most notably by Siskin & Little (1995). Based originally on university models where subject matter and disciplinary specialization was dictated by research lines of inquiry, high school departments for most of the 20th century were not recognized as important factors in the cultural milieu of high schools, including the lives of teachers, the experiences of students, or the challenges of administrators and policy-makers. The result of this entrenched structure has been the establishing of dense barriers to school-wide communication, “realms” where power is wielded by key actors (department leaders, or specific departments) around acquisition of and access to resources, and preformed social delineations that determine whose ideas influence whom (Grossman & Stodolsky, 1995). Of particular note, the teachers in Siskin & Little’s study revealed how the subject matter in different departments took on varying hierarchies, with those who teach mathematics and science at the highest level of social structure, then language arts
and social studies, and then the non-academic subjects. Teachers in the “lower caste” departments reported feeling “invisible” and de-valued in other studies (McLaughlin & Talbert, 2001), and this before legislation which tests only the four academic subjects and links teacher accountability to those tests (No Child left Behind Act of 2001/2008).

**Teachers, Mathematics, and Teaching in High School**

While the structure of high schools and teachers’ lives within subject departments undoubtedly influence teaching practice, high school teachers themselves, and the beliefs and values that they bring into their classrooms, is important to consider as well. Teaching has been characterized as attracting people to the profession for reasons of interpersonal relations and self-worth (wanting to work with young people and wanting to be of service to others), and personal/career benefits (jobs security and time off during the summer) (Lortie, 1975). Lortie’s sociological analysis of teaching, the profiles of those who enter the profession, and deep-rooted school structures revealed three distinct characteristics that he said described the lives of teachers. *Conservatism* describes the tendency he found in teachers to embrace the teaching methods with which they themselves were taught. Familiar and traditional teaching routines were seen as providing structure and stability to a practice that can be daunting, given the many elements that cannot be controlled (students, administrators, policy mandates, etc). Therefore, teachers seek support for their existing instructional practices, rather than experimenting with new and unknown, potentially threatening, teaching approaches. Lortie’s second finding, *individualism*, was a depiction of the propensity of teachers to prefer autonomy, individual accountability, and the freedom to define their own criteria
for success. Teacher individualism was a response by teachers, Lortie claimed, to a system with weak criteria for assessment and achievement (for teachers) and ambiguous guidelines for judging those criteria. This led to a culture characterized by a lack of clarity of expectations, a “sink-or-swim” mentality, and teachers who were short-term task-oriented. Finally, *presentism* represented the preference of teachers to focus on the here and now of their work lives rather than investing in long term endeavors which would improve their practice. The structure of the educational system (tenure, step-pay increases based on years of experience rather than merit, and lack of a sense of ever achieving “mastery”) which he saw as “front-loading” the careers of teachers resulted in a reward structure for teachers that “favors immediate gratification rather than long-range perspectives” (Lortie, 1975, p. 212).

Siskin & Little’s (1994) study around the role departmental divisions in high schools played in high school culture and the lives of teachers both confirmed and extended Lortie’s findings of teacher isolation and localized, short-term decision-making. An environment of divided academic disciplines, imposed by departmental boundaries, results in different assumptions about the nature of student learning, what constitutes good teaching, and the subject matter itself (Grossman & Stodolsky, 1995; Little, 2002; McLaughlin & Talbert, 2001; Siskin & Little, 1995; Talbert & McLaughlin, 2002). They are significant in defining the boundaries of what is acceptable in the professional lives of high school teachers and in determining their professional identity. Teacher social networks, teacher communication, learning opportunities, and access to professional resources based on the makeup and leadership of varying departments were all
substantially impacted by teacher identification with certain departments (McLaughlin & Talbert, 2001). A result of teacher isolation, autonomy, and leadership patterns, high school departmental structure results in unique and discernible sub-cultures that shape group norms, often strengthening shared traditional beliefs and practices of the collective as veteran teachers enculturate new teachers, assuring the conveyance of these group values and beliefs to future educators (Grossman & Stodolsky, 1995).

A majority of high school departments fit this description, characterized as *enacting traditions* in McLaughlin & Talbert’s (2001) large scale study of high schools, teachers, and professional learning communities. Teachers in this category worked to maintain the status quo, saw their subject matter as static, and operated in teacher-centered contexts in which students were expected to receive information and respond in teacher-directed ways. Teachers here had a high degree of certainty about the effectiveness of their teaching, although their methods were found to impact traditional learners only, as all “subject-area orthodoxies” (p. 21) were left unexamined. A second type of teacher community was characterized as *lowering expectations and standards*. This group modified expectations of student ability in order to resolve the tension between traditional teaching methods and student resistance to those approaches. These teachers, like those in the “enacting traditions” category, saw educational problems as residing with the students rather than with their instructional approaches. Their response, however, was to alter their performance expectations of students instead. This attitude, although acknowledged at all levels, was found to be most common in the lower track classes. Teachers believed that this approach would lead to student success and more
self-confidence in their work, so an ethic of care was at play here. However, this approach resulted in limited success with students. The third category, observed much less often than the previous two, was described as *innovating to engage students in high-level content*. These teachers examined their assumptions about their subject matter and their students and worked on new approaches to try to connect the two. They transformed themselves to see their roles as teachers as being open to student ideas, being flexible with their approaches and delivery, and as seeing all students as capable individuals with unique strengths and weaknesses.

Although McLaughlin & Talbert’s study found that teaching approaches did not always line up with specific subject areas, there has been speculation as to the influence of the subject matter itself on how it is taught. Early calls for reform in mathematics teaching were a reaction to traditional methods that were “entirely out of relation to the real exhibition of the mathematical spirit in modern thought…(one that doesn’t) generate (in pupils) a capacity to apply ideas to the concrete universe” (Whitehead, 1912, cited in Betz, 1950, p. 380) and, for the most part, went unheeded. Teachers often believe that mathematics content is static and unchanging, and these beliefs are connected to their beliefs about mathematics teaching (Steffe, 1990):

The mathematics teacher’s aversion to activities involving material explanation is quite comprehensible. They probably see a sort of reference to the physical properties of objects and might fear that
empirical verifications will harm the development of the deductive and purely rational mind which characterizes their discipline (Piaget, 1973).

Fleener (2005) linked the beliefs entrenched in a positivistic view of the world to those within mathematics:

Belief in universal truth (and) objective measures … are consequences of an emphasis on the scientific method as the paragon of rationality…Assuming mathematics to be objective and pure, applying mathematical measurement allows for abstraction and confirmation. Mathematics offers the means for predictive calculation and nature becomes quantifiable, predictable and controllable… We have confused mathematics as a tool for mathematics as the representation of reality or truth (Fleener, 2005, p. 7).

Cultural assumptions and identity (Grossman et al., 2001) are implicit in these models of mathematics teaching and learning, and are often unquestioned:

In the classroom, the teacher and the textbook are the authorities, and mathematics is not a subject to be created or explored. In school, the truth is given in the teachers’ explanations and the answer book; there is no zig-zag between conjectures and arguments for their validity, and one could hardly imagine hearing the words maybe or perhaps in a lesson. Knowing mathematics in school therefore comes to mean having a set of unexamined beliefs (Lampert, 1990).
Parents extend and reinforce this belief; in some districts that have successfully implemented teaching reform at the K-8 level in mathematics, parents, given a choice of traditional or reform-oriented approaches at the high school level chose traditional course sequences (Lubienski, 2004).

**High School Mathematics Teachers and Curriculum**

Related to teacher beliefs about mathematics is their use of curriculum materials to support their instruction. High school teachers have a strong, especially resilient, relationship with mathematics curricula and textbooks, one that is very different from their K-8 teacher peers. Much of mathematics teacher beliefs about mathematics, as well as decisions about course planning, curriculum mapping, and assessment writing can be traced directly to the texts that teachers employ for teaching their mathematics courses (Grouws, Tarr, Sears, & Ross, 2010; Weiss, Pasley, Smith, Banilower, & Heck, 2003). This reliance on the text is much stronger for high school mathematics departments than it is for any of their other secondary peers, who show more propensity to use the text as a resource to be consulted when needed rather than as the one essential guide to their lesson plans (Little, 2002; Remillard, 2005). In 2000, 80% of high school mathematics teachers polled in a national study reported using a single textbook as their source for instruction, and the textbooks used came from one of only three publishers (Whittington, 2002). Teachers reported that they covered 75% of the textbook in their instructional year, and a majority considered the curriculum content to be good, very good, or excellent.
This pattern persists in spite of evidence of effectiveness in organizing courses around larger mathematical themes (Boaler, 2002; McCaffrey et al., 2001; Schoen & Hirsch, 2003) or “habits of mind” which guide students to become mathematical thinkers (Cuoco, Goldenberg, & Mark, 1996), as opposed to teaching courses around traditional delineations that are meant to prepare students to be mathematicians. Of importance here are indications that modifications in instructional practice at the high school level most often lead to gains in student achievement when accompanied by changes in curriculum (McCaffrey, et al., 2001).

Also of concern is the acceptance of and reliance on the textbook by teachers as the sole source of instruction by high school mathematics teachers, in spite of studies like those of Harel & Wilson of the American Mathematical Society (2011) which found that the most popular high school mathematics textbooks did not develop important mathematical topics coherently, were often incorrect, and were presented neither rigorously nor in a focused manner (Harel & Wilson, 2011).

These issues around curriculum use are significant. There has been considerable progress in K-8 settings with using curriculum materials as tools for reform (Brown, 2009; Stein & Kim, 2008), wherein teachers are able to use the materials to learn substantial mathematics while customizing instruction for their unique classroom situations. It is a skill which Brown (2009) terms “pedagogical design capacity” wherein what is valued is not just what teachers know mathematically, but teachers’ “skill in perceiving the affordances of the mathematics and making decisions about how to use
them to craft instructional episodes that achieve her goals” (Brown, 2009, p. 29). High school teachers have as yet not been afforded this opportunity, whether due to Lortie’s conservatism (Lortie, 1975), lack of support from administration, absence of curriculum materials that foster teacher learning (Stein & Kim, 2008), or lack of quality professional development.

**Teachers as Learners: Models of Professional Growth**

Models of learning, for most of the twentieth century, were dominated by a positivist orientation, a belief that “truth” was an entity that was intact and able to be “discovered” or uncovered. Knowledge was seen as existing separate from the knower (Davis, 2004), and systematic use of the scientific method was perceived as leading to unveiling larger and larger pieces of this “truth” (Gage, 1978). The “mind”, as the conduit of “knowing”, was treated as a physical structure that responded simply and predictably to stimuli in the environment (Gage, 1978), and the measurable, attainable “products” (or responses) associated with acquisition of knowledge made the phenomena of learning reducible, and thus easy to study and replicate in classroom (Davis, 1951).

Teaching, therefore, was typically viewed as a “craft” that, with enough motivation and practice, was able to be mastered one element at a time (similar to a “stimulus-response” learned behavior) (Hoban, 2002). Likewise, teacher learning experiences were designed to allow teachers to accumulate needed content or pedagogical knowledge in what Sfard has termed an “acquisitionist” stance (Sfard, 1998). Professional development experiences (both pre-service and in-service) were thought to
work best when they allowed for the greatest amount of information to be transferred to the teacher, a solitary learner in the process of acquiring knowledge systematically. One-day workshops, guest presenters, and professional development disconnected from teacher input were sites of teacher learning under the behaviorist paradigm.

Theories around learning, however, began to shift in the 1960s, after the Soviet launch of the rocket Sputnik. Researchers who conducted large-scale curriculum development projects realized that new paradigms were needed in order to answer questions about “how” and “why” learning occurred instead of just “what” learning had occurred. Davis (1967) described this shift in the definition of “learning” as a “change in behavior” to a “change in students’ cognitive schemes” (p. 12). Constructivism as a learning theory began to be used in place of behaviorism as explanations for student ideas and misconceptions were explored in more depth. In this school of thought, the learner is seen as interacting with the mathematics using prior knowledge as well as mental schemas or conceptual maps that made sense to them, or that fit their already developing notions (von Glasersfeld, 1984). Active construction of mathematical meaning, rather than passive reception, involves engagement with mathematical objects, hypotheses and conjectures around mathematical ideas, use of mathematical procedures, and communication within a mathematical community that requires justification and defense of ideas (Davis, Maher, & Noddings, 1990b). The role of the teacher in this interplay of thought and meaning becomes crucial as they provide an environment geared towards mathematical meaning-making, pose worthwhile tasks, model problem solving behavior
and provide support for learners as they negotiate meaning for themselves (Ball, Thames, & Phelps, 2008).

Co-emergent with constructivist notions of individual cognition were theories of socio-cultural learning from within philosophy and anthropology. Learning is defined in this context as the result of the use of artifacts, language, sign systems and practices associated with an individual’s specific culture (Cobb, 2007). Under the social learning paradigm, mathematical learning cannot be separated from the tools and symbols that learners use to represent it, nor from the cultural context in which community meaning has been agreed upon. Other philosopher-researchers (Habermas, 1984/1987) looked at learning as intimately tied up with community practices around communication. Here, knowledge is created through human dialogue, negotiated meanings, and interpretations which emerge as the context in which they are formed changes (Coulter, 2001). In mathematics education, these socio-cultural theories were interpreted as “emergent” (Simon, 1997), and, combined with newer cognitive models, represented a richer understanding of learning. Cobb described the interplay between the two views:

The basic relation posited between students’ constructive activities and the classroom social processes in which they participate is one of reflexivity in which neither is given pre-eminence over the other. In this view, the students are considered to contribute to the evolving classroom mathematical practices as they reorganize their individual mathematical activities. Conversely, the ways in which they make these reorganizations
are constrained by their participation in the evolving classroom practices
(Cobb & Yackel, 1996).

With such a different lens on student learning, it is no surprise that models of
teaching were likewise impacted. Instead of a set of discrete, learnable skills, the act of
teaching began to be viewed as continuous and complicated, more art than craft (Gage,
1978; Hoban, 2002), more based on complex weighing of options than on skilled use of
tools. This new type of teacher knowledge represented a “knowing how” vs. “knowing
that,” (Shulman, 1986) for example, “knowing how” to get students to understand key
mathematical concepts instead of “knowing that” the steps or skills within procedures can
lead to correct answers (Simon, Tzur, Heinz, Kinzel, & Smith, 2000). Shulman (1986)
began to tease out the implications for teaching that emerged with the new conceptions of
knowledge acquisition:

I was struck by this incredible anomaly that while physicians were being
studied as complex, autonomous, thoughtful, reflective, strategic
problem-solvers, teaching was studied as if it were a series of mindless
behaviors emitted by teachers in response to students as stimuli. It grew
out of a totally different conception of the behavioral sciences. And so I
began to raise the question: What would research on teaching actually
look like if we thought about teachers with the same kind of respect and
complexity that we hold for physicians and other professionals?
(Shulman, 2001)
The types of knowledge needed for effective teaching, Shulman claimed, included the familiar content knowledge and curricular knowledge, but now also included *pedagogical content knowledge*. This is the specialized knowledge teachers must negotiate between the region of mathematics content knowledge (the “what”) and pedagogical knowledge (the “how”) (Shulman, 1986), including how to ask mathematical questions, how to pose tasks that will engender the most mathematical growth, how to push students’ thinking as well as challenge misconceptions, and decisions about the best methods for assessing and evaluating student learning (Ball et al., 2008).

Increasingly, views of the practice of teaching as complex and non-discrete ushered in descriptions and models that attempted to capture the interplay of students, teacher, curriculum and the “milieu” or culture surrounding all of them (Schwab, 1971). Models of teacher learning had often been too narrowly focused on individual elements, such as adjustments in curriculum, new content recommendations, or new pedagogical strategies (Reeder, 2008). Constructs that pay heed to the complex interplay of the student, the teacher, the curriculum and the surrounding cultural milieu of the school and classroom require that we “go beyond (a conception of) ‘teaching as method’ towards ‘teaching as relationships of meaning’” (Reeder, 2008, p. 250).

Some of the first researchers to break from a cognitive paradigm began to ask how knowledge was influenced by communication and interaction within groups. Lave & Wenger (1991) focused on social discourse to “emphasize the significance of shifting the analytical focus from the individual as learner to *learning as participation in the*
social world, and from the concept of cognitive processes to the more-encompassing view of social practice” (p. 43, emphasis added). Learning in this context is defined to be that which occurs as a result of participation in collaborative activities, a process they called “legitimate peripheral participation” (p. 29). As the authors studied groups and the interaction between apprentice and experienced group members, they noted the power of a “social process (that) includes, indeed subsumes, the learning of knowledgeable skills” (p. 29). This theoretical framework applied to schools represented a large shift in how teacher learning was defined. As research in the field progressed, theories about how teachers learn evolved to include teachers in communities redefining their own practice, in spaces where teacher learning came to be viewed “not as bound and delivered, but activated” (Wilson & Berne, 1999).

Teacher professional growth began to be seen in terms of an interplay between multiple levels of cognitive and social elements (Putnam & Borko, 2000), including teacher construction of knowledge (personal cognition), teachers actions in community (social nature of cognition), and teacher learning as centered in the classroom (the situated perspective of cognition). Later considered as crucial to understanding the social environment of teaching were the elements of school leadership, school politics, and school culture (Hoban, 2002), a theoretical orientation that incorporates learning across a social setting, learning within an individual, and dynamic interplay between each of the elements. Complexity models of teaching draw on knowledge of complex systems (Davis, 2008) found in the natural world (ecosystems) or in anthropology (tribal groups) to note the similarities between them and mathematics classrooms: they evolve, change,
grow, and learn (Davis & Simmt, 2003). These systems are “coherent (and) knowledge-producing”, and are “not just the sum of their parts, but the product of parts of their interactions” (Davis & Simmt, 2003, p. 138).

It follows that the most promising models of teacher development were seen to engage teachers as learners, in collaborative and reflective peer groups, of the same content their students study (Wilson & Berne, 1999). This view of teacher learning as situated and complex led Cochran-Smith & Lytle (1993) to propose that the central goal of all teacher education endeavors should be “learning from teaching.” Teacher inquiry across a lifetime of practice, including the processes of formulating conjectures, trying out strategies and reflecting on lessons, both individually and collaboratively with peers, is where the onus of teacher learning takes place. As such, schools and classrooms should be treated as research sites and places where teachers act as inquirers into and generators of knowledge. Japanese Lesson Study is one such model, where teachers plan and implement “research lessons” for study and reflection by a team of peers and sometimes university professors (Stigler & Hiebert, 1999). Lessons are pre-planned with the group, analyzed and improved with reflective group members, re-taught (often by another teacher in the research group), and written up in a report that is shared with all of the teachers and administrators in the school. In a “learning through practice” model such as this, teacher knowledge is culturally situated and therefore able to be studied through a lens of change in disposition and practice. A related model is that of “teaching rehearsals”, proposed by Horn (2010) as a way of having teachers examine their practice methodically, around issues that they care about (students and mathematics), and with
peer review and interaction for immediate and meaningful feedback. These models allowed teachers to become “co-constructors of the local knowledge of curriculum”, mathematics content and students (Han, 2006).

Teacher learning then, throughout decades of research, is seen as a construct that has changed and emerged along with different notions of how learning should be defined as well as how it should be studied. Teachers do not learn in a vacuum – their learning results from complex interactions involving their prior experiences, content knowledge, pedagogical knowledge, knowledge of their students, curricular influences, and the social environment of their classroom, school and surrounding community. In studies of the past two decades that acknowledge the multifaceted nature of teacher knowledge, communities or networks of teachers have played a central role in how teacher knowledge is conveyed and created anew. In what ways has the notion of “teacher community” been defined? What models involving teacher collaboration have evolved in reaction to the meshing of socio-cultural and cognitive learning theories?

**Professional Learning Communities**

**Background and Models**

In the past several decades, the notion of teacher learning communities, grounded in socio-cultural theories of learning (Vygotsky, 1978), in which learning is viewed as situated within a common-vision peer group (Lave & Wenger, 1991) and influenced by interactions within the group (Little, 1990), has received increased attention. Many studies have claimed that these communities have the potential to transform teacher
practice (DuFour, DuFour, Eaker, & Karhanek, 2004; Henderson & Gornik, 2007; McLaughlin & Talbert, 2006), while others have questioned their effectiveness (Levine & Marcus, 2010).

In one of the earlier studies of peer group social processes, Lave & Wenger (1991) defined “learning” as occurring when groups were engaged in collaborative practice, a construct they termed communities of practice. Within these communities, the researchers observed new group members being mentored and guided through successive levels of participation in a phenomenon they named legitimate peripheral participation. Through gradual enculturation by experienced members, much of which relied on stories and cultural artifacts passed down, new group members gained knowledge about their practice and profession. This study marked a turning point wherein teacher learning in future research in the field was defined not implicitly understood in terms of didactic information transfer, but expanded to include learning in the context of social, professional relationships.

Viewing learning as legitimate peripheral participation means that learning is not merely a condition for membership, but is itself an evolving form of membership. We conceive of identities as long-term, living relations between persons and their place and participation in communities of practice. Thus identity, knowing, and social membership entail one another (Lave & Wenger, 1991, p. 53).
Lieberman & McLaughlin (1992) were among the first to define these teacher groups in terms of “networks”, and positioned the work teachers engaged there as opportunities for them to experience learning in a constructivist manner, which in turn aided them in transforming their own classrooms for their students.

When they construct ideas about practice with their colleagues, teachers act as both experts and apprentices, teachers and learners. Members of networks report an intellectual and emotional stimulation that gives them the courage to engage students differently in the classroom -- an opportunity especially valued by teachers working in urban schools. (Lieberman & McLaughlin, 1992, p 674)

This type of collaborative, knowledge-building work was defined as teacher inquiry by Cochran-Smith & Lytle (1993). As teachers together explored different theoretical stances in their practice, they engaged in a type of classroom-based research that enriched their own knowledge as well as those in the learning community. Teacher knowledge was thus held up as “generative”, emergent, and interdependent on the process of collaborative sense-making. Teacher-initiated questions about previously taken-for-granted aspects of their own teaching led to the generation of new knowledge, which the researchers claimed, should “alter – not just add to – what we know in the field” (p. 85). This study was one of the first among many (e.g., Lachance & Confrey,
that called for the elevation of teachers to the level of “professional” based on their collaborative work around rituals of practice.

Clandinin & Connelly (1996) envisioned teacher expertise as ensconced in teacher knowledge landscapes, a place where the different elements of teacher’s personal knowledge, school setting, and public policy and theory interacted and impacted teachers’ professional lives in varying ways. Using teacher stories as data, the research probed into the different types of knowledge teachers embody and in what context this knowledge becomes useful. Their more inclusive model of teacher community, embodying aspects of teachers’ cognitive, social and political lives, allowed for interpretations of teacher action and knowledge to be seen as ultimately bound up in context; what teachers “know” depends on the situation in which they are called on to use the knowledge. This research frame:

- allows us to talk about space, time, and place. It has a sense of expansiveness and the possibility of being filled with diverse people, things, and events in different relationships. Because we see the professional knowledge landscape as composed of relationships among people, places, and things, we see it as both an intellectual and a moral landscape (Clandinin & Connelly, 1996, p. 25).

Recent work has built on the foundational models of Lave & Wenger, Lieberman, Cochran-Smith & Lytle, and Clandinin & Connelly. These studies examined teacher learning through a situated lens (Lave & Wenger, 1991; Lave & Wenger, 2002) wherein
knowledge was seen as embedded in the context of teachers’ social environment and work lives. Central themes that emerged from this work included: 1) teacher cognition is located within specific physical and social contexts; 2) teacher learning occurs as the system orients new members to its environment; however, the influence is not one-dimensional; the system changes as well; 3) cognition is distributed across the individual, the group members, and the physical and symbolic artifacts created in the learning process (Putnam & Borko, 2000). A focus on the discourse patterns used by teachers as they navigated new curriculum, new content or the building of collegial peer groups helped to illuminate how teachers process and use information from these various domains (Borko, 2004; Horn, 2005; Little, 2002). A related study (Horn, 2010) investigated the manner in which collegial conversations between teachers contributed to re-contextualization of knowledge, wherein theoretical stances were negotiated through classroom episodes, how this information was modified to fit specific contexts, and how the group interaction assisted in this process.

The QUASAR study, a large-scale initiative involving six economically disadvantaged middle schools along with “resource partners” (mathematics educators from higher education), used Lave & Wenger’s (1991) communities of practice model in its work with teachers as they implemented a reform mathematics program (Stein, Silver, & Smith, 1998). Noting that many mathematics teachers operate in isolation from one another, the authors sought to facilitate a network that was comfortable sharing ideas with one another about planning, instructional practice, and ways to evaluate student mathematics thinking as well as act as support for one another throughout the change
process. Several years later, Kazemi & Franke (2004), working with elementary mathematics teachers who were implementing reform-oriented mathematics curricula, tracked the ways teachers’ participation with their learning group shifted or changed. Significant in this study was the focus on the process teachers engaged in as they made sense of new curricula and new mathematics, and the significant knowledge gained by the teachers as a result of participation in the community.

Kazemi & Hubbard (2008) challenged the more-typical “unidirectional” questions around teacher learning they were seeing in the literature (such as “to what extent does participation in professional development affect teachers’ classroom practice?”). Drawing on research in mathematics education, the researchers framed their study questions in terms of the “co-evolution of participation between classroom practice and professional development” (p. 428), and looked at how aspects of professional development (specifically, stories, images, artifacts, and enactments around effective practice) were transformed as they traveled between teacher learning groups, to the classroom, and back again. The resulting research was able to focus more intently on the complex work teachers undertake.

Achinstein (2002), drawing on research from organizational theory, framed teacher collaborative work as a “micro-political system” in order to incorporate formerly taken-for-granted elements such as tension, conflict, competition and struggle. Research up to this point had described teacher work in a way that was “overly harmonious” (p. 422), missing, she claimed, opportunities to view teacher collaborative spaces as a context for further learning and professional renewal. Much like a political system,
teacher groups must constantly manage conflict, power relationships, and tension between internal and external ideologies. To Achinstein, the way communities negotiated conflict was a determining factor in the level of transformative learning that took place there: groups that reacted by ignoring or suppressing the conflict remained at a level she called “status quo” where learning was inhibited. Groups that managed the conflict by creating feedback loops and outlets for teacher reflection were afforded opportunities to strengthen their group support structure and thus increase professional learning. This study, and later work by Hargreaves (2010), used the notions of conflict, ideology and border politics to reveal a richer picture of teacher interaction and learning.

Davis & Sumara (2001; 2006), in a long-term study of a school that had been restructured from the ground up (all new teachers and administrators in the same year), analyzed teacher learning through a definition of learning as “transformation – one that expands the learner’s range of action” (p. 90). The researchers rejected typical learning models that dichotomized or separated such elements as external/internal, mental/physical, and individual/collective through a model that recognized learning as emergent, self-modifying, reflective and as moving through a series of nested levels of knowledge. Complexity theory informs this model by stating that no change or event at any level in the model is isolated, simple, or void of consequence – any modification to a part of the system impacts all other elements of the system, albeit in varying time scales. Furthermore, the learning occurring within such a system is not experienced only by individuals:
A learner is a complex unity that is capable of adapting itself to the sorts of new and diverse circumstances that an active agent is likely to encounter in a dynamic world… So, learners can include individuals, but also social and classroom groupings, schools, communities, bodies of knowledge, languages, cultures, species… or organs, bodily subsystems, cells, neurons…The learner can be considered simultaneously a coherent unity, a complex of interacting unities, or a part of a grander unit. (Davis & Sumara, 2006, p.14)

Given the increased attention towards teachers as collective learners and the viability of the research construct to describe teacher growth, it is no surprise that the research corpus shows a gradual shift, from models that focus on the actions of individual teachers while in community learning settings towards those that integrate group cognition and social interaction and begin to recognize the texture and complexity of “systems” of teacher learners.

**Characteristics of Effective Professional Learning Communities**

In this section, I focus on the attributes and descriptors of teacher learning communities, those that both encourage and inhibit group and individual growth. Special attention is paid to the issue of conflict and the role it plays in teacher network interactions and propensity to grow and learn. What have these models demonstrated to be the characteristics of successful teacher community groups, and what have they found to be inhibitors of learning?
**Context relevant to teachers.** Within the realm of teacher learning, much as in student learning (Davis, Maher, & Noddings, 1990a), context matters. Teacher groups that were the most successful at encouraging teacher growth were those that were designed around work that matters to teachers. Whether it was having teachers collaboratively examine student work while planning instructional moves (Graham, 2007; Hipp et al., 2008; Horn, 2005; Kazemi & Franke, 2004), or having teachers learn more in-depth content knowledge (Hofman & Dijkstra, 2010; Lachance & Confrey, 2003), robust learning networks focused their efforts on meaningful tasks that were either situated in or would translate to classroom practice. Teacher learning is “episodic” and classroom “event-structured” (Borko, 2004), and therefore more successful when it is attached to actual classroom practice. Teachers in these groups held what Cochran-Smith & Lytle (1993) called a “deliberative view” of teaching and were intentional about their study and scholarship around teaching.

LaChance & Confrey (2003) found that, when structures were in place to allow teachers to explore mathematical content together in a respectful environment, change was more likely to occur, both in the teaching within mathematics classes and in relationships between group members. Together, these two components – mathematical content explorations and teacher community – provided these secondary mathematics teachers with a strong foundation for engaging in the reform of their mathematics classes.

In a comparative case study of two high schools who were implementing whole-school reform, Horn (2005) examined the resources that mathematics teachers used to decipher and understand new approaches to their instructional practice. At one site,
where reform activities were being led by facilitators from outside of the department, discussions around the nuanced meanings of mathematics content and vocabulary did not occur. The group’s view of mathematics consequently was not impacted as much as the second high school site where teachers took responsibility for facilitating their own discussions (a characteristic addressed below as *autonomy*). In this case, the author points out, the “mystique of mathematics” (p. 256) impacted the reform goal of cross-content and inner-departmental collaboration. At both sites, however, the research found that reform initiatives were more effective due to opportunities for teachers to collaborate and consult with one another around classroom episodes and student work samples.

**Cautions:** In some teacher groups that over-emphasized collegiality, the focus on deeper mathematics content knowledge was minimized (Wilson & Berne, 1999) thus negating the possible benefits of group cognition around important mathematics (or other) content. Grossman, et al (2001) noted an “essential tension” when teachers convene for professional development, between professional practice on the one hand (with a focus on, for example, standards, curriculum guides, textbook review, assessment writing, etc) and intellectual growth on the other (with a focus on learning new content, or looking at known content in new ways). In their sessions with members of two high school departments, different teachers were pre-disposed towards one stance or the other. In many schools (particularly high schools), intellectual growth by teachers in collaboration is not valued, and pursuit of this impacts the existing norms of individual autonomy (with regard to teaching practice) (Wilson & Berne, 1999) as well upsets the authoritarian, leveled structure of schools.
In one study (Rousseau, 2004), a group of high school Pre-Algebra teachers had collectively agreed on the need to de-track their Algebra I students, and decided to implement a curriculum reform together. The group, considered high-functioning due to agreed-on norms, collective purpose and willingness to collaborate, agreed that the purpose of the Pre-Algebra course was to prepare students for Algebra I. Group tensions began to surface, however, around conflicting definitions of what it means to know and do mathematics – skills and procedures or knowing how and when to apply those tools. The new curriculum presented alternative ways of engaging students in what it defined as important mathematics. Teachers, rather than examining their taken-for-granted beliefs about mathematics, students and learning, discussed their perceived shortcomings of the curriculum and the students. The reform eventually was abandoned due to the group’s avoidance of conflicting beliefs and refusal to attempt to consolidate differing viewpoints.

Grossman & Stodolsky (1995) likewise found that mathematics teachers valued sequentiality in the subject as they envisioned mathematics as “defined” rather than open or changing. The mathematics department displayed a higher degree of curricular autonomy (meaning the curriculum dictated their instructional moves), were more likely to be able to coordinate course content with colleagues than other subject areas, and were more likely to have common exams. As a result of their strongly-held views, this group showed the strongest support for tracking students. The study draws attention to how teacher beliefs impact the possibilities for collaboration and coordination of curricular approaches (with texts, with other teachers at the high school level, etc).
Other studies (Olson & Craig, 2001; Sack, 2008; Shank, 2006; Walsh, 2003) report successful learning community formation around the activity of collective reflection. These groups generally wrote on a regular basis around a theme that was chosen by the group as targeted towards a common goal, and then shared their written and oral reflections in an environment that had established norms and safe boundaries (Craig, 2004). For high school mathematics teachers, this can be considered a potentially threatening, unsafe exercise due to their expertise in a non-verbal content area (Grossman & Stodolsky, 1995). Their comfort level is with discussing mathematical ideas and solutions, and their students’ struggles and approaches to mathematics. This idea is related to Davis and Simmt’s (2003) finding that, in viewing mathematics teacher communities through a complexity lens, “neighbor interactions” came to be defined as the mathematical ideas, hunches and thoughts shared between group members. Their boundaries were seen in terms of the elements with which mathematics teachers operate most comfortably and successfully.

These studies highlight the tension which can occur between group cultural beliefs and curriculum or student perspectives. Effective groups need to recognize and manage this tension, as well as the sometimes divergent goals of pursuing content expertise vs. pedagogical knowledge, or emphasizing professional practice vs. intellectual growth. This requires “both intellectual and social work on the part of teachers” (Grossman, et al, 2001, p. 974).
**Discourse and norms of participation.** Beginning with the earliest “formal” teacher community studies, patterns and boundaries around teacher communication have been recognized as critical variables when considering whether or not teacher collaborative study results in growth. Studies that analyzed discourse patterns (e.g., Little, 2002) found that the structures around teacher communication (either assumed or formally established) work to both enhance and impede a group’s ability to learn. For example, Little’s (2003) study of high school teacher communication patterns, she noted different teacher comfort levels with the group goals. Social studies teachers, for example, were more apt to engage in convergent thinking as they tried to get the group to agree on a single solution or approach to a question. Language arts teachers, on the other hand, were accustomed to sharing divergent opinions and, in fact, felt that agreeing on a single answer demonstrated a lack of thought around the question. Likewise, mathematics teachers communicated with very different patterns, wherein issues such as math anxiety or math avoidance came into play. Little noted that the ways teachers questioned one another, allowed for differing opinions to be discussed and welcomed discourse around disagreement, provided “affordances” in learning: communication structures in some cases opened up possibilities for learning and closed them off in others.

Boundaries around communication, depending on whether or not they allowed for deeper “critical colleagueship” (Lord, 1994) in which teachers confronted unexamined practices with a critical eye towards improvement (LaChance & Confrey, 2003), impacted heavily the group’s ability to function and grow. Open dialogue in a safe environment, welcoming and discussing dissenting views, teacher and group self-
reflection and the insistence on hearing all voices led to teacher learning that went beyond that of groups without those structures in place (Borko, 2004; Cochran-Smith & Lytle, 1999; Hofman & Dijkstra, 2010; Wilson & Berne, 1999). When norms were established explicitly, requiring equal voices for all and with a focus on listening to all viewpoints (Little 2003), teacher groups were able to establish lines of open communication and trust (Hipp, et al. 2008) in an environment in which the group responsibility for respectful communication was in the forefront (Grossman, et al, 2001; LaChance & Confrey, 2003).

Cautions: Being open to multiple viewpoints and hearing all voices inevitably leads to tension around those who disagree. Groups need to be ready to navigate through this tension (Grossman, et al, 2001; Little, 2003) in order to be able to go beyond reactive or superficial system responses (Achinstein, 2002). This requires taking notice of where the boundaries have been set (both consciously and unconsciously) and what happens when teachers approach those borders (Clandenin & Connelly, 1996; Sack, 2008). Placing group focus solely on content or student outcomes, without a structure in place for productive discourse, does not allow the group to self-reflect or to enter into “critical colleagueship” (Levine & Marcus, 2010), often leading to teacher frustration, demotivation and group dysfunction (Achinstein, 2002; Hargreaves, 2010).

Additionally, Grossman, et al (2001) found that caution was in order in interpretation of teacher stories. Translation of these stories from classroom to study group is never representative of the actual occurrence, thus teacher interpretation of and attempts to replicate classroom successes can be problematic. In other words, classroom
successes (and failures) are not always transferable. Likewise, some models of teacher community cannot be applied successfully with different groups. Elementary mathematics collaborations (e.g., Kazemi and Franke, 2004) successfully used models that emphasized the learning of new mathematics content (around a reform curriculum implementation). When this model was used at the high school level, however, cultural boundaries around teachers having to be experts in content knowledge were breached and critical conversations could not happen Grossman, et al., 2001). Little (2002) also found that different high school departments communicated differently, thus revealing a tension between attempting reform within a single department vs. attempting whole school reform. One often negates the other.

Teachers’ social environments play a role in defining these norms and beliefs. If they are left unexamined, and if groups are merely put together for the sake of examining practice without the needed collaborative structures in place that allow for this type of conflict to emerge and adapt, learning communities will falter (Levine & Marcus, 2010). This is an important distinction as schools may rush to provide time for teachers to make professional decisions, but fail to provide the flexible leadership and normative guidelines that will allow for success (DuFour, 2004).

“Different types of collaboration can create very different learning opportunities for participants. … Decisions about the structure and focus of teachers’ collaborative activities can both facilitate and constrain what teachers can learn together by influencing: whether teachers make their own practices in the classroom public; which aspects of teaching are
discussed; the degree of specificity with which teachers share aspects of their work; and the kinds of information about students teachers make available to each other” (Levine & Marcus, p. 391).

**Collective sense of responsibility.** Throughout the literature, healthy working teacher communities were those who had grown to value group knowledge and to approach the work of the collegial team as a responsibility to the group for its growth and development, a shift from “distributed cognition” to “cognition distributed” (Grossman, et al, 2001, p. 975). Davis and Sumara (2001) describe a transition within a team of new teachers at a newly structured school where they noticed their writing shifting from using “I” references to using “we”, evidence that group identity had been established with a “collective purpose” and was being welcomed and nurtured. These communities embraced shared leadership, collective learning (Davis & Simmt, 2006), and a common moral purpose (Hipp, et al., 2008). Knowledge was shared publicly, through the use of public artifacts (Little, 2003), joint construction of texts or stories (Cochran-Smith & Lytle, 1999), examination of tacit taken-for-granted knowledge and assumptions (Wood, 2007) and generating new, emergent knowledge (situated within their practice) (Cochran-Smith & Lytle, 1999). They resisted becoming a “closed system”, comfortable in their group identity, disallowing outside opinions or theories to enter into the system thus reliving the same theoretical and intellectual roles over and over (Grossman, et al, 2001; LaChance & Confrey, 2003; Little, 2003). These teacher networks also had overcome the pressure inherent in many schools that does not allow a teacher (apprentice or experienced) to admit that he or she “doesn’t know” (Lave & Wenger, 2002)
Cautions: Lave & Wenger (1991) warned about definitions of “community” that don’t acknowledge the difficult work and conflict inherent in becoming a collective that shares responsibility for its growth. Definitions of “community” that emphasize only the “feel-good” nature of community “done right” are misleading and can be damaging to groups who go there unaware (Wood, 2007).

**Group autonomy.** In healthy learning communities in the literature, teachers knew that their own knowledge contributed to the generation of new knowledge and that meaningful learning experiences had been organized from within the group (Cochran-Smith & Lytle, 1993; Cochran-Smith & Lytle, 1999). Teachers embraced the differences within the group as opportunities for learning, taking responsibility for generating their own learning, considering outside (of the group) opinions, and developing critical judgment around their own work (Wood, 2007). They had transcended “contrived collegiality” (Hargreaves, 1991) to arrive at a true collaborative culture, where conflict was expected and productively managed. Teachers were treated as professionals whose opinions and experience around their classrooms and students counted in times of decision-making and power-sharing. Teacher networks that focused on teacher self-reflection, that exploited subgroups, maintained a strong content focus were able to stimulate enthusiasm and led to opportunities for the application of new materials/methods in the classroom (Hofman & Dijkstra, 2010).

Cautions: School administrative leadership plays a large role in creating the structures, and fostering a culture, where teacher knowledge is respected and held central to the teacher learning process (Little, 2003; Graham, 2007; Hipp, et al., 2008). Teacher
isolation and a culture accustomed to full teacher individual autonomy is a difficult obstacle to overcome (Little, 1990), even with the support of leadership. On the other hand, in schools where there is too much imposed structure from outside of teacher groups (e.g., defining of problems for learning communities to investigate, insisting on structured teacher meetings around student data, supplying agendas for learning community meetings, etc.), teachers became de-motivated, resentful and were apt to withdraw from collaborative conversations (Hargreaves, 2010). In situations where the internal rewards of allowing group strengths to emerge and generate new growth were restricted or denied, groups dispersed (Rousseau, 2004), and teachers reported a sense of “sinking professional motivation and lost classroom creativity” (Hargreaves, 2010, p. 149).

In this sense, if professional learning communities become another imposed restriction on teacher professionalism and creativity, as they have in many schools, they run the risk of becoming yet another failed attempt at large-scale school reform. As schools are forced to implement “feel-good” models of teacher community, well-meaning leaders are imposing a structure that is antithetical to the definition of “professional,” leaving teachers feeling (yet again) powerless with no room for professional judgment (Wood, 2007; Hargreaves, 2010). This is not dissimilar from the concern raised by Bosse` (1995) over the very “traditional” way that the very non-traditional NCTM Curriculum and Evaluation standards were presented to teachers for implementation, as a solution to their mathematical ills, with no room for teacher interpretation or professional judgment. Worse yet, imposing additional restrictions on teachers through the channel
of learning communities provides a conduit for more stringent teacher resistance to reform ideas that are backed by a solid base of research (Giles & Hargreaves, 2006).

**Professional Learning Communities at the High School Level**

Studies of high school level professional learning communities have, in general, had mixed success. This is not surprising when one considers, as one should, the specific institutional structures that are unique to high schools: short class periods with different teachers throughout the day, subject matter specialists as teachers, courses whose content does not intersect with other course content, teachers whose principal relationship is with the content rather than the students.

When we turn to the school level (particularly the high school), the most logical venue for day-to-day community, we run into a series of structural, cultural, and vocational impediments. The simple fact is that in the American high school the structures for on-going intellectual community do not exist (Grossman, et al., 2001, p. 11).

Additionally, when one considers Lortie’s (1975) characterization of teachers’ professional adaptations to these structures as conservative (preserving and working with what is known and familiar), individualistic (success is reached through self-driven efforts at coping with ambiguous boundaries), and present-centered (career rewards are front-loaded), it is not surprising that efforts to form professional learning communities at this level often had unintended results.

In examining the results of peer collaboration, Wenger (1998) found that communities of practice are not intrinsically beneficial or detrimental. He highlighted
how groups used their collective agreement around traditional and familiar notions of their practice to en-culturate new members into the group, a use of “community” that often did not result in reflection and work on improvement of practice. This is similar to the findings of McLaughlin & Talbert (2001) in their study of high school learning communities. In their work at sixteen schools over 4 years, the researchers observed distinct patterns in the way teachers interacted and in the work that they engaged in while in departmental settings. All of the teachers in the study identified students as the context of their teaching, but the way that the different groups viewed their students varied, with some groups stressing above all the differences in students in the present day (holding an idealistic of view of students of that past as hard-working, respectful and academically gifted), while others looked for strengths in the diversity of their students. Additionally, all teachers identified strongly with their subject matter.

The ways in which teachers viewed their students and the manner in which they collaborated around the teaching of their subject matter led to group interactions of three types. *Weak learning communities* were those whose members worked in isolation from one another, met in department meetings only to share information about procedures, rules and building/department rituals. Successful teaching in these communities was considered a matter of individual teacher quality and the backgrounds of their students, rather than a function of policy, curriculum, pedagogical approaches, or collaborative work. Other high school sites had *strong professional communities*, meaning the groups had a collective sense of their work’s purpose and worked well together to achieve it, however, there were two contrasting cultures within these communities. *Strong*
traditional communities were those in which teachers’ agreed-on cultural norms included teaching to pre-determined course material, the testing and sorting of individual students according to their perceived ability, and critical views of students as well as alternative teaching approaches. As observed by Rousseau (2004), these groups found strength in their common belief and confidence in familiar teaching practices, the need to track students in order to allow gifted students to thrive (and to provide intervention to struggling students), and that students and/or parents were to blame for shortcomings. In contrast, strong innovative learning communities were those who viewed their work as shared responsibility to the students as well as to the content. Their purpose, owned collectively, was to meet the needs of their students based on individual needs, without lowering standards or expectations. These groups saw their subject matter as central, but not “given”, needing constant review and re-working in order to achieve success with students.

For example, in a comparison of two high school mathematics departments, one was able to transcend initial concerns about staying true to the content by collaboratively viewing and working through the material through the eyes of their students, while another remained convinced that there was nothing that could be done to improve the mathematical understanding of certain populations of their students (the lower students, the underserved populations). The researchers saw the differences in these teacher collaborative groups as reflective of divisions and cultural conflicts in American society, “signaling divisions in secondary education that are deepening in the 21st century” (McLaughlin & Talbert, 2001, p. 11).
The authors summarized their findings by stressing that due to high school culture being built upon teachers working in isolation from one another, sorted into subject-specific groups that carry their own strong identities and resulting pedagogical practices as a result, creating collaborative groups there around issues of improved student learning and teaching practice is problematic and challenging. Any efforts at reforming teaching practice using the vehicle of professional learning communities, which have proven effective in K–8 settings, must take these structural impediments into consideration.

There is evidence that cross-departmental collaboration can be effective in having teachers examine their assumptions about students and learning. Shank (2006) created a structure for teachers’ storytelling around the challenges and successes of teaching. Trust developed around the sharing of common frustrations, which in turn allowed teachers to create their own space for new learning and for the sharing of new ideas. It is possible that this trust was able to develop due to the cross-departmental structure of the group which changed the existing intra-departmental teacher hierarchy. Referencing Lortie’s (1975) categories of teacher disposition, the McLaughlin & Talbert (2001) call for high school teachers to make the shift “from individualism to collaboration, from conservatism to innovation” (p. 126-128), in order for student success to occur.

Teaching and Definitions of Social Capital

Given that there have been successes with some groups of high school mathematics teachers who, under certain conditions, have been able to transform their practice and their teacher communities into a “strong innovative” collective of learners, it follows that deeper questions around the conditions that allow these transformations to
occur are worthy of investigation. One perspective is to consider teacher experiences and opinions around their notions of social capital, or how they feel that their social/collective group interactions help them to access resources for improving their practice. Coburn & Russell (2008) identified limitations of the existing research on professional learning communities: it does not provide information about specific mechanisms that can lead to increased teacher learning; the studies typically hold the department or group as the unit of analysis, ignoring the effects of the larger system in which the group and embedded; and lastly, the studies focus mostly on positive community interactions as a way to increase teacher learning, ignoring examples where communities inhibited teacher growth. Although my own reading focused on several studies or portions of studies where community interactions have not led to teacher transformations, I agree with the authors’ assessment of a need to direct questions towards a more fine-grained analysis of what teachers see as valuable and not valuable in their professional relations with peers. High school mathematics teachers, in particular, are interesting to study in that their conceptions of their subject matter, their status within their school, and their relationship with their students have been positioned in the literature as potentially impacting what they value in terms of access to resources.

Definitions of social capital in education have evolved from applications and research which originated in the social sciences (sociology, political science and economics). Described as the salient features of a district’s capacity to define, implement and sustain instructional reform, Spillane & Thompson (1997) used more familiar definitions of capital to frame the centrality of social capital in a teaching setting.
Physical, or financial capital, consists of the material or financial resources in a district which can be allocated to impact learning, such as teachers’ schedule during the school day, staffing decisions, physical and curriculum materials purchased, and teachers’ physical location in a building or district. Human capital is defined as the knowledge, skills and intrinsic motivation which teachers, administrators and school leaders possess and employ as they go about their professional work. Social capital, like human capital, is not a physical entity, but a measure of the level of expertise contained in a network as well as how readily a group is able to access this expertise. These three forms of capital are intertwined and interdependent: “the nature, value, and sometimes even existence of each depends critically on one or both of the others (Spillane & Thompson, 1997, p. 190). Of the three, social capital has only recently been seen as having important application and implications in a school setting.

French sociologist Pierre Bourdieu (1977) was one of the first to operationalize a definition of social capital as “the sum of the resources, actual or virtual, that accrue to an individual or group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition” (Burt, 2001, p. 32). Adler & Kwon (2002) have characterized this definition and others like it as “external” or a “bridging” view, where strong ties can lead to advantages of individuals over other actors who are linked distantly in a larger social network. Economic models, for example, construing competitive advantage of one group over another have used this lens. In contrast, Coleman (1988) defined social capital in terms of the advantages it brought to individuals within a specified structure or organization. This perspective,
termed “internal” or a “bonding view”, focuses on “linkages among individuals or groups within the collectivity and, specifically, (on) those features that give the collectivity cohesiveness and thereby facilitate the pursuit of collective goals” (Adler & Kwon, 2002, p. 21). The authors, however, favor a definition that has elements of both internal and external ties, one which incorporates both the functions of bridging and bonding:

Social capital is the goodwill available to individuals or groups (whose) source lies in the structure and content of the actor's social relations (and which impacts) the information, influence, and solidarity it makes available to the actor (Adler & Kwon, 2002, p. 23).

This definition fits the function of teacher networks and groups, whether formal or informal, who utilize trust, norms and exchange of information to improve their practice and to, at times, “facilitate coordinated action” (Burt, 2001, p. 32).

Early applications of the concept of social capital in educational research, depending on the definition under consideration, were situated within different theoretical orientations. Bourdieu’s interpretations (1977) led his research to view social capital as an explanation for different levels of academic achievement, offering an alternative to view to prevailing theories of skill deficit models. Coleman applied his definitions of social capital to examine large scale longitudinal data sets to conclude that student access to his measures of social capital (two-parent homes, number of siblings, educational expectations) led to greater academic success (Dika & Kusum, 2002). Applications of the more critical approach (Bourdieu’s “cultural reproduction” interpretation) include
research on student career choices, classroom language studies and family-school relations. Coleman’s work, however, has held the most influence in subsequent studies of social capital (and in much mainline educational research). Many claims and widely-held beliefs about school achievement are owed to the largely uncritical acceptance of Coleman’s research examining family structure and parent-child interaction variables with achievement gain scores in large scale quantitative studies (Dika & Kusum, 2002).

Recently, interpretations of social capital in educational research has taken a different turn, towards interpretations of resources made available to teachers through interaction with colleagues and social/professional relationships that enable changes in instructional practice (Coburn & Russell, 2008). Coburn & Russell (2008) examined how policy set in two large urban districts impacted teachers’ social networks as they worked to implement reform-oriented mathematics curricula. The researchers used existing studies to choose and analyze four dimensions that they saw as salient in elementary mathematics teaching: structure of the teacher network (how connected the teachers were to one another professionally), access to expertise (formalized as math coaches at their sites), trust of one another, and levels of professional communication (low level indicating discussion mainly of lesson pacing and surface lesson planning; high level indicating talk of student thinking and their own sense-making of mathematical ideas).

Cobb’s current five-year longitudinal project (“Middle School Mathematics and the Institutional Setting of Teaching”) uses Coburn & Russell’s constructs of social
capital to examine how district supports of mathematics teaching impact student achievement and teacher efficacy while implementing new mathematics teaching approaches (Cobb, 2012). Other recent studies have examined social networks in schools as a measure of a school’s innovative climate and the principal’s role therein (Moolenaar, Daly, & Sleegers, 2010) and a school’s ability to foster a shared vision for change among teachers and staff (Penuel, Piel, Krause, & Frank, 2009). Although social capital was not one of the dimensions measured in these studies, teacher access to resources through social networks (principal leadership in one, shared vision in the other) was a central theme in both studies.

A core focus of this study was the definition of social capital as it pertains to high school mathematics teachers. The dimensions targeted by Coburn & Russell were appropriate for elementary and middle school teacher networks, but what, for example, might constitute “access to content expertise” in a high school setting where math coaches are not present? The importance of hierarchical relationships in notions of social capital found by Adler & Kwon (2002) potentially apply here, where high school departmental organization often dictates whose knowledge and expertise holds more influence (Siskin & Little, 1995; Little, 2002). Scribner & Bradley-Levine's (2010) findings of teacher leadership roles in an urban high school (categorized as organizationally legitimized, institutionally legitimized, and gendered) might be descriptive of the types of network leadership resources teachers value in a high school setting.
Stein & Kim’s (2008) definition of social capital in terms of a district decision to adopt and implement certain mathematics texts was researched through an examination of several elementary school implementations of reform-oriented commercial curricula. How might definitions around social capital and curricular resources vary for high school teachers who have quite different, more authoritative, relationships with textbooks than do their elementary counterparts (Grouws et al., 2010; Weiss et al., 2003)? Horn (2005) found that teacher collaborative work around classroom interactions resulted in “reform artifacts” and cultural conversation-based classification systems which rendered collective pedagogical assumptions. These types of studies led to the need to discriminate between the conditions that lead to the acquisition of social capital, as opposed to the actual elements or dimensions that compose social capital.

**Social Network Analysis**

Social capital, defined as the resources and expertise that teachers access through social channels that allow for greater productivity and individual growth (Adler & Kwon, 2002), presents itself within a network structure, i.e., “resources and expertise are embedded within particular positions in a social network and not freely available to anyone in a particular system” (Penuel et al., 2009, p. 124). Thus, teacher access to these elements requires social interaction through a network that consists of sets of nodes or actors (the individuals, teachers, administrators or others) who are linked through a series of ties (Wellman & Wortley, 1990) (communication patterns, etc), and limited by certain cultural criteria (the boundaries established by the social environment in which they are embedded) (McAdam, 2003). Adams (2000) noted how social network analysis
has allowed for research to shift from the more traditional organizational, policy level focus to that of the more informal social interactions of teachers. He highlighted the attributes of these teacher networks as: how access is defined through the interconnectedness of the teacher nodes, the kind of information that is transmitted (content of network interactions), the types of relationships in the network (trusting, collaborative), frequency of interaction, and the strength of the connections between the network members, or “tie strength.”

Supovitz & Weinbaum (2008) used Coleman’s (1988) definitions of social interactions within networks to frame their comparative study of how high schools implemented large-scale reform programs. Pertinent to their questions of how teachers were supported in their professional growth by district personnel and resources, the authors focused on how teacher social interactions influenced the reform efforts: networks established a system of obligations and expectations that connected those in the schools, helped define social norms within their communities, served to transmit or diffuse new information throughout the group, and connected social capital to teachers’ individual conceptualizations and adaptations of the reforms.

More recent research has begun to use the social network structure itself as a unit of analysis. Moolenaar, et al. (2010) focused on teacher networks which formed around innovation and change initiatives. The study used social network analysis to gather data around patterns of exchange of advice and creative ideas, and analyzed how networks varied across schools with different innovative climates. While much of what occurs
within teacher networks was beyond the scope of this study, as well as the specific structure of the network of this teacher groups’ network, gaining access to teacher perceptions of how their social environment afford or constrains resource acquisition was facilitated by paying attention to community ties that allowed resources to flow through them (Wellman & Wortley, 1990). Tie relationships within a network can be characterized as “direct”, those that take place through explicit communication and interaction, or “indirect”, those which share relevant activities or resources through mutual involvement in group initiatives (McAdam, 2003).

Social ties are also described in terms of strength, reflecting how frequently communication between actors occurs, and the emotional/social closeness of those interactions (Coburn & Russell, 2008). “Strong tie” relationships describe communication patterns which involve the transfer of complex knowledge, reciprocal problem solving, and the sharing of “coordinated solutions” (Coburn & Russell, 2008, p. 207). Strong-tie relationships, as indicators of professional trust between individuals (Coburn & Russell, 2008), are more likely to elicit more accurate teacher perceptions of social interactions around unexamined notions of social capital (Adler & Kwon, 2002). Pairing teachers in strong-tie dyads helped to create more open conversations where trust had been previously established (Burt, 2001; Adler & Kwon, 2002).

Summary

This section outlined research on the unique culture of high schools, the sociological research on why teachers teach, and some of the particular issues
surrounding high school mathematics departments. An extensive body of research on teacher professional learning communities was reviewed in light of the potential for that construct to impact teacher instructional practice. The characteristics of effective learning communities were described as well as cautions, and the special challenges of attempting to initiate and build learning communities at the high school level. Examining the special issues surrounding high school mathematics teaching and how to transform teaching practice there through the lens of social capital was introduced, with a summary of the background of that research, definitions, how the research has been applied in educational settings, and finally, how it might pertain to high school mathematics teaching and teachers.
CHAPTER III

DESIGN AND METHODOLOGY

In this chapter, I focus on the context of the study, including the district, school, teacher participants, and a federal/state mathematics grant which funded the larger study from which this project emerged. I describe the findings from an earlier preliminary study which impacted the design of this study, as well ideas around combining narrative inquiry with social network analysis as a methodology. Finally, I describe the research tools I employed, including my data collection and analysis methods, and the validity and reliability measures which were appropriate to this study.

Purpose of the Study and Statement of Research Questions

In this study, I was interested in learning more about high school mathematics teachers’ conceptions of social capital from their vantage point and in terms of their lived experiences. How do high school mathematics teachers think about and approach improving their teaching practice, and what resources do they access as they do so? To what resources (if any) does collaborative planning, teaching and peer observation afford teachers as they focus on improving their mathematics content and pedagogical knowledge? What aspects of teachers’ “social capital” are present within the traditional structures of an American high school when viewed through the eyes of the teachers as they collectively examine their practice? The study examined the following questions:
1. What elements of high school mathematics teachers’ social environment do high school teachers see as affording or constraining their ability to improve instruction?

2. How do high school mathematics teachers define the dimensions of their own social capital?

3. How does participation in a collaborative teaching/planning cycle impact individual and collective views of social capital within a high school mathematics department?

**Theoretical Framework**

Adler and Kwon’s (2002) conceptualization of the constructs which contribute to social capital began with definitions of the network actors’ social relations.

*Figure 1: Adler and Kwon’s “Conceptual Model of Social Capital” (2002)*
Based in organizational theory, the model delineates three dimensions of the social relations of actors within a network: market relations (in which goods and services are exchanged), hierarchical relations (in which authoritative relationships provide stability and security), and social relations, wherein network members access resources, including “information, influence and solidarity” (Adler & Kwon, 2002, p. 23), through the social ties they maintain. The three key elements of social capital were defined as opportunity, motivation and ability. “Opportunity” consists of the social ties which exist and allow resources to flow between network members and include both internal ties (the connections within the network) and external ties (to resources outside of the group). “Motivation” addresses the central role that trust and norms of interaction between group members play in the exchange of resources within a network wherein reciprocity and community obligations are understood and acted on in ways that help to keep the network bound together. Finally, “ability” is the knowledge and competence which the individual members or actors bring to the network.

The three components were combined in this model to form social capital, and interacted with organizational contingencies (how closely the network activities align with the goals of the larger organization) and complementary capabilities (combining capabilities from disconnected sources in new ways to form additional resources) to result in increased value (in the form of enhanced assets) to the organization. These additional resources are then cycled back into the network’s available social resources (Adler & Kwon, 2002).
Elements of social capital from Adler & Kwon’s organizational theory context were applied in school settings by Coburn & Russell (2008) to interpret the elements of social capital for teachers in K-8 settings (mathematics teachers, specifically).

“Opportunity” in their general organizational model was termed “Structure” in teacher networks, and defined in terms of the nature of quality of teacher relationships (tie strength) and the connectedness of teachers to one another as well as to those outside of their immediate teacher group (tie span, similar to Adler & Kwon’s characterization of internal and external ties). “Motivation” in the Adler & Kwon model was called “Trust” by Coburn & Russell, and discussed in terms of what motivated teachers to share information with one another. “Ability” in the original model was called “Access to Expertise” in the education-based model and was conceptualized in Coburn & Russell’s study as teacher networks’ access to math coaches. Additionally, the Coburn/Russell model included a fourth element of social capital which they termed “Depth of Interaction.” Here, the researchers acknowledged the importance of analyzing the substance and meaning of teacher communication amongst one another, highlighting the role that teacher interaction plays in teachers’ implementation of instructional and curricular reform.
The current study, which examined high school teachers’ views of their professional social environment, as well as perceptions of the dimensions of their social capital, used the central constructs of each of these studies to analyze group narratives around the resources teachers accessed as learners. The initial categories, gleaned from the theoretical models and representing the theorized dimensions of social capital, are summarized in Table 2:

*Figure 2: Coburn and Russell’s (2008) “Sources of Social Capital”*
Table 2: Categories or Dimensions of Social Capital Present in Current Models

<table>
<thead>
<tr>
<th>Category or Dimension</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity/Structure</td>
<td>Opportunity for teachers to collaborate, talk, discuss, have professional conversations</td>
</tr>
<tr>
<td>Motivation/Trust</td>
<td>Degree to which teachers trust those in the social professional network; closeness of teachers to others in the network</td>
</tr>
<tr>
<td>Ability/Access to Expertise</td>
<td>Knowledge contained by those in the network; level of mathematics content knowledge; knowledge of teaching (general) and how to interact effectively with students</td>
</tr>
<tr>
<td>Depth of Interaction</td>
<td>Extent to which conversations involved low-depth vs. high-depth issues surrounding teaching (low depth – pacing, scope and sequence; high depth = student thinking around tasks and how instruction can address student misconceptions, etc)</td>
</tr>
</tbody>
</table>

Background and Context of the Study

The District and School

The West City School District (pseudonym) was situated within a small town in the mid-west that is heavily industrial and centered originally around manufacturing infrastructure built up around the steel industry. With the movement of much of the manufacture of steel overseas, the community has struggled to maintain jobs and the
higher standard of living that other communities enjoy. A community of 43,000 citizens, it lost about 7% of its population in the first decade of 2000. The median income in 2009 was $30,507, only slightly higher than the median income of the community in 2000, and $15,000 less than the state’s median income. Approximately 70% of the community was white, while 25% was African American. With unemployment at 15%, the most common industry is manufacturing, with labor-oriented jobs (assemblers, laborers, metal workers, etc) as the most common occupations. Job growth was at (-8.22)% for the 12 months preceding June, 2010 (U.S. Department of Commerce, 2011).

The school district’s demographics included a balance of 42% white students and 47% African American students. The district was designated as “Academic Watch” on the state’s academic “report card” as it met only 2 of the 26 indicators in 2010 which the state deemed important as measures of academic achievement. These measures included criterion-referenced test scores at grades 3 – 8 and grades 10-12, as well as overall district attendance rate, and graduation rate. West High School is the only public high school in the community, and is situated somewhat centrally near the city’s downtown area. The student population of the school is rather large (1766 students), representing a rank of 42nd largest high school in the state, with a large proportion of students who are on free and reduced lunch (35%) (Ohio Department of Education, 2012).

Administrators in the district who were involved in decision-making around the project (described below) included the district-level Curriculum Director, the high school principal, and an assistant principal who was in charge of school-wide professional development. The superintendent had been involved in original planning meetings, but
did not participate in ongoing meetings throughout the year, and vacated the
superintendency position at the end of the first year of the project. At the start of the
2010-11 school year, the mathematics department began implementing a district mandate
which eliminated “below grade level” freshman Algebra classes, thus beginning a “de-
tracking” of all future mathematics classes (with the exception of an accelerated track in
which approximately 10% of the students were enrolled). This work was additional to a
multi-year school-wide improvement initiative in which all teachers at the high school
were involved, including two previous years of professional development around literacy
strategies, establishing group norms of participation among teacher groups, writing
common course assessments, and creating and implementing intervention lessons for
students based on common assessment data. A third district-mandated change initiative
included the adoption and implementation of a new inquiry-oriented mathematics
curriculum. Two years prior to the study, a small group of teachers and administrators
had decided to adopt the curriculum for all high school mathematics courses, with strong
urging and support from the Curriculum Director. With scant professional development
for the teaching staff, the general attitude towards the new curriculum, even by some of
the teachers who had initially chosen it, was quite negative.

The Teacher Participants

The Mathematics Department at West High School included 11 classroom
teachers and 3 special education teachers, all of whom were Caucasian. The 4 males and
10 females agreed to participate in 120 hours of professional development with one
another, led by university mathematics education researchers and assisted by university
mathematicians, as part of a partnership project to improve student achievement in mathematics. The majority of teachers in the department had the responsibility for teaching two courses (one teacher taught only Geometry, and one teacher taught all Calculus, AP Calculus and AP Physics courses). Teachers taught classes in 43-minute periods, with a common planning period during their first period each day. The Mathematics Department used this time during the course of the project to meet one morning a week for collaboration and department work on project-focused activities and district-level mandates. The remainder of the teaching day consisted of class periods with students throughout the day and responsibilities to oversee students during lunch in the lunchroom. Teachers’ official lunch period occurred at the end of the day, at 2:30, when teachers were free to leave the building (although the official school day end time was 3:00).

The West High School/Midwest University Mathematics Partnership Project

Beginning in 2010, monies were awarded to support a West High School/University Mathematics Partnership. This project, funded through state and federal Math/Science Partnership funds, had three goals at its core: increasing student mathematics achievement through improving teacher content knowledge, increasing teacher knowledge of mathematics teaching, and offering support for the establishment of a learning community among the mathematics department and between university educators. In the spring of 2010, teachers were asked to identify their areas of greatest need in terms of professional learning. The project’s principal investigators used this information to create a “menu” of professional development options that teachers then
ranked in order to choose the experiences that would be the most beneficial to them. Some of the areas of need identified included curriculum alignment with the Common Core State Standards for Mathematics, strategies for differentiation, location of resources for rich mathematics problems, and assistance with strategies for intervention with struggling students. I was supported as a Research Assistant for the project to help with data collection and analysis, planning and implementation of ongoing project activities, and to document evidence around the group’s formation of a learning community.

Teacher meetings began in the summer of 2010 with a dinner at a local restaurant, in which teachers and school administrators were introduced to the project investigators, results of preliminary needs assessment (as determined by the teachers) were shared with the teachers, and details around the project and the planned year-long project-related professional activities were outlined. Forty hours of professional development were planned and implemented during August, in which teachers completed curriculum maps, solved and discussed rich problems, became familiar with the Common Core State Standards, and investigated strategies for intervention and differentiation. Meetings with teachers occurred regularly during the school year as well. Wednesday mornings were 30-minute weekly time periods used for ongoing projects, teacher feedback, reflection, and sharing of data and information. Portions of the once-per-month early release days (one to one-and-a-half hours), scheduled and planned by the building principal, were allowed to be used by the project investigators to continue project-related projects.

Throughout the course of the project year, though the goals of the project remained intact, the specific activities and experiences provided for the teachers via the
project changed and were tailored in response to teacher requests, district- and school-
level initiatives, and data analysis by the project co-PIs. In iterative cycles of ongoing
data collection and analysis, often in direct response to teacher or administrator expressed
needs, professional development content and context were adaptive and emergent. As
the year progressed, there were several school-level and district mandates which required
the mathematics teachers to engage in professional work that was unanticipated during
the planning and early months of the project. These included a professional development
day led by the publisher of their “official” adopted math text (the new text which had
been adopted two years prior), the writing of common assessments for every course,
creation of intervention lessons for students based on results of common assessments,
writing a course of study for a new fourth-year mathematics course, and choosing a
textbook to support the course of study for that new course. These mandates required
that some of the planned actions of the project be modified, truncated or, in some cases,
eliminated altogether.

One emergent modification was to introduce a reflective peer teaching cycle
model in the Spring of 2011 to pull together both the overriding goals of the project as
well as the district improvement initiatives which had been imposed by building and
district administrators. This model, a hybrid form of the Japanese Lesson Study Model
(Gorman, Mark, & Nikula, 2010; Stigler & Hiebert, 1999), was developed by the project
investigators and myself in response to initial data gathered in the project and in a
preliminary study I conducted beginning in the Fall of 2010 (description follows in the
next section). The model, represented in Figure 3 below, was designed to take advantage
of the core tenets of lesson study (peer planning using outside resources, public lessons, collective reflection on the lesson, collaborative recommendations on how the lesson can be improved and used in future teaching) while fitting into a teaching schedule that was much more restrictive than those in elementary or middle school settings. In our case, the West High School schedule with its 43-minute periods was even more restrictive than those of other high schools who have adopted block schedules, modified block schedules, or longer teaching periods (of at least 50 minutes) during the school day.

Beginning with the choice of a “rich mathematics problem” (one with which the teachers were not familiar), the groups worked collaboratively with one another, with university mathematicians, and with university mathematics educators to make sense of the problem, investigate the mathematics, and then discuss what is important about the mathematics in the problem. Teachers then discussed what technology might be needed to implement the lesson, as well as which pedagogical teaching moves would best serve the purpose of getting students to engage with the mathematical ideas at great depth. Teachers chose a day in either April or May in which they rotated together throughout the day and through the model’s cycle of teach/peer observe for one period, debrief as a group the next period, switch teachers and repeat the teaching/observation cycle (Figure 3). At the end of the day, teachers had experienced the same lesson three times and had discussed the lesson continually throughout.
Preliminary Study Questions and Findings

In a preliminary study which took place during the fall and winter of 2010-2011, I investigated how the high school mathematics teachers perceived their group, how these perceptions were changing as teachers spent more time in collective spaces, and the impact that group collaboration had on teacher propensity to contribute to the activities and growth of the (departmental) community. One of the goals of the larger study was to establish a mathematics teacher learning community that enabled teachers to continue to grow professionally beyond the project duration, thus I was interested in documenting teacher experiences within their professional group.
Data was gathered from informal teacher interviews, field notes taken at group meetings (professional development sessions, department meetings and school staff meetings), memos written before and after teacher meetings, and observations of teacher collaborative meetings. The data were analyzed to look for patterns or themes (Schram, 2006) that would inform my dissertation study. Themes that emerged included: (a) teacher frustration due to decisions made unilaterally by administration with little or no teacher input (textbook choices, decisions about testing of students, dates and times of meetings for which they would have to be out of their classrooms); (b) teachers’ feelings of defeat and of being unappreciated by administration and the community due to low test scores, and teacher frustration around the challenges of teaching in an urban setting with low student motivation and limited parental support; (c) teacher willingness to inspect and improve their practice in spite of these frustrations, and a willingness to identify areas where they needed support (for example, teachers requested help with learning statistics, methods of mathematical modeling, technology, how to get students to work in small groups, and how to ask better questions of students); and (d) an ethic of care for their students that often led to reduced expectations and wanting to lessen student struggle with difficult mathematics, a pattern of lowering standards noted in other studies of high school teaching (McLaughlin & Talbert, 2001). This data revealed a group of high school teachers who were asking and searching for resources to improve their teaching practice, even while faced with challenging circumstances that were beyond their control, and job-related stresses which often made them feel undervalued and
voiceless. Many of their assumptions about mathematics and student mathematical ability were stated as fact, taken for granted, and unexamined.

As these themes emerged, my questions around teacher access to resources began to develop. Previous studies (McLaughlin & Talbert, 2001; Rousseau, 2004; Sack, 2008; Supovitz & Weinbaum, 2008) had identified the challenges inherent in working with or trying to develop high school mathematics learning communities. The preliminary study affirmed their findings, and caused me to consider how the structural differences in high school teachers’ environment (their schedules, relationships with the subject matter, relationships with students, relationships with administration, and their place in the educational hierarchy) might impact teacher ideas about what resources are the most valuable in terms of their professional growth. What is it about the high school setting that makes teacher identification of and access to resources unique? How do high school mathematics teachers think about and approach improving their teaching practice and what resources do they access as they do so? Are there high-impact reforms that schools could employ to assure that high school teachers have more ready access to the social capital resources that they need to improve their practice? How does participation in such practices as lesson study, peer lesson planning, or peer observation impact perceptions of social capital within a high school mathematics department?

Many new recommended innovations in mathematics education have been designed using research from the K-8 level, with very different sorts of constraints (Fennema et al., 1996; Gorman et al., 2010; Kazemi & Franke, 2004; Stein et al., 2008).
My own past experiences with teachers in those grade levels, as well as with inquiry-oriented instructional practices and curricula, had shown me that teachers working in community, with support from high quality curriculum materials, were able to identify, access and share resources in order to improve their teaching practice, often in the face of frustrations with administrators, school boards, parents and one another. What did this type of social capital look like at the high school level and what were high school teachers’ perceptions around notions of collective social capital?

Table 1 (in the previous chapter) demonstrated that this dissertation study, although overlapping in some areas with the original project (which funded the professional development for the teachers throughout the year) and the preliminary study conducted by me, was presented as a separate research project with different a focus.

**Methodology**

Given that this study emerged from questions posed within a larger study, and that findings from my preliminary study led to emergent questions about the nature of high school mathematics teachers’ approaches to improving their practice, it was decided that some elements of “design research” were appropriate for this study. Kelly, Baek, Lesh, & Bannan-Ritland (2008) argue for the use of research methodologies which reflect the ‘fluid, empathetic, dynamic, environment-responsive, future-oriented and solution-focused nature of (research) design… a space of novelty tempered by research evidence that unfolds over multiple cycles” (p. 5). The methodology and research questions for this study co-emerged along with the experiences and lived stories of the teachers as they
examined their professional practice and collectively worked to improve the mathematics experiences of their students.

**Role of the Researcher**

Ongoing and extended involvement with the teachers throughout the school year, as well as dual roles of “researcher” and “content coach” (Shank, 2006) allowed for trust relationships to develop between the researchers and the teachers. The long-term commitment of the researchers at the site in multiple contexts meant that we were not there merely as passive observers, but as resources for support. The support provided to teachers varied, including providing materials which teachers either borrowed or purchased, ideas developed with the research team (mathematics educators and mathematicians) around instructional strategies, assistance with writing and analyzing common assessments, time for large and small group collaboration around mathematics content and pedagogical strategies, time for personal reflection, time and support to meet district and school mandates, and a space for the sharing of new insights as well as frustrations. We were thus privy to teacher stories, celebrations and disappointments as they negotiated the ongoing demands of teaching high school mathematics. Like Shank (2006) who wondered why certain teacher stories were told over and over, narratives told and retold by this group were important indicators of what they valued as social capital.

**Data Collection and Analysis**

This study used narrative methods to gather teacher stories and views around their work, what they considered to be important resources for them to be successful in their
work, and the social contacts they felt best helped them to garner these resources. I was particularly interested in their reactions to the Peer Observation Lesson experience wherein each teacher was faced with a new lesson to read, understand and teach in a public forum open to peer review. A mixed methods design employing both qualitative and quantitative methods allowed for the capture of rich, social context of the data and provided an opportunity for teachers to engage in collective meaning-making, a space that could reveal previously unexamined notions of social capital held by this group of teachers. Figure 4 below diagrams the phases of data collection and data analysis.

Elaborations on each of the phases follows.

Figure 4: Phases of Data Collection and Data Analysis
Phase I: Quantitative social network data used to pair teachers in high-trust, strong-tie dyads for interviews. The initial phase employed quantitative methods from social network analysis (Ibarra & Andrews, 1993) in order to determine teacher groupings for semi-structured interviews (Rubin & Rubin, 2005) in which each teacher would be paired with another teacher with whom they shared a high-trust, strong-tie relationship.

Social network analysis background. My research questions focused on the perceptions of teachers about social capital—the resources and expertise they consider valuable as they examine and try to improve their own teaching practice. As I asked teachers to share their experiences of needing and seeking help with an issue they faced in their professional practice, sensitivity was required on the part of the researcher (Hesse-Biber & Leavy, 2006). When teachers are asked to make public their teaching (as in the common lesson) and their difficulties with instructional decisions, this is often unfamiliar territory for them professionally and can lead to issues that are particularly sensitive. This is especially true of high school mathematics teachers who are more accustomed than most teachers to exhibiting authority within the school culture due to the privileging of mathematics content (Siskin & Little, 1995) and who often have established, authoritative and often unexamined routines of interacting with one another, mathematics and instructional decisions (McLaughlin & Talbert, 2001; Grossman, et al, 2001).

Paying attention to how teachers network with one another through the use of social network analysis allowed me to identify groups or pairs who had utilized their ties
with one another to gain access to resources. In this way, detecting teacher perceptions of social capital was afforded by paying attention up front to the community ties that allowed resources to flow through them (Wellman & Wortley, 1990). Strong-tie relationships are indicators of professional trust between individuals (Coburn & Russell, 2008), and thus are more likely to elicit accounts which can capture unexamined notions of social capital (Adler & Kwon, 2002). Pairing teachers in strong-tie groups encouraged more open conversations since trust had been previously established (Burt, 2001; Adler & Kwon, 2002; Bryk and Schneider, 2002). These conditions increased the likelihood that common narratives would emerge, that agreement would be reached on “evaluation statements” in common stories (Cortazzi, 1993), and that group themes around social capital would be more visible. These are important considerations given the social lives of high school teachers, which typically are quite limited when it comes to trust relationships around professional themes and issues (McLaughlin & Talbert, 2001).

Finally, teacher discussions around what they don’t know and what they consider as critical questions in their practice (Richert, 2002) are important windows to revealing teacher beliefs and norms around their practice.

Some studies have used the social network structure itself as a unit of analysis to, for example, analyze how networks vary across schools with different innovative climates (Moolenaar et al., 2010). This study, in contrast, used the existing network structure of the teacher group to uncover the most likely strong-tie pairs in order to facilitate gathering of data that was valid, convincing and reliable. Thus, the design had inherent in it a sensitivity to bias on the part of the researcher (teacher pairs designated by
me would have been based on my limited knowledge of their professional resource-sharing relationships), teacher narrative authority (their own experiences are privileged here), and mathematics teacher cultural mores around discussions of what is not known or understood. This design feature also addressed the need in studies that are predominantly qualitative in nature for validity measures (Arrow, McGrath, & Berdahl, 2000; Webster & Mertova, 2007) that include plausibility of the narrative and coherence of the story to those evoked by others (Riessman, 1993).

**Social network data collection.** Teachers were first asked to complete an online survey which posed the following questions (adapted from Moolenaar, et al., 2010):

- Who are the 3 people in the department you consulted the most for professional advice (something about your teaching, your students, etc)?

- Who are the 3 people in the department who came to you for professional advice the most often?

Teacher responses to these questions were collected into matrices, which were then entered into network analysis software (Borgatti, Everett, & Freeman, 2002). Statistical models analyzed the relationships and “tie structure” between the teachers as reported and network graphing software (Borgatti, 2002) used the data to create a visual model of this group’s network ties. The graph and resulting data output illustrated how teachers “clustered” within professional advice networks (Borgatti & Ofem, 2010). The data was then used to pair teachers into dyads or triads for Phase II of the data collection, the teacher interviews. Pairing teachers in strong-tie groups was intentional to create more
open conversations where trust had previously been established (Burt, 2001; Adler & Kwon, 2002).

**Phase II: Teacher interviews in strong-tie dyads and triads.** The qualitative phase of the study involved the gathering of cultural and social narratives around issues of access to resources and group identification of teaching assets.

**Narrative inquiry.** Teacher experiences are culturally situated and their stories help to capture and honor the complexity of the environments in which they operate (Clandinin & Connelly, 1996; Clandinin & Connelly, 2000). Documenting and sharing teachers’ accounts of lived experiences was first presented as a legitimate research methodology by Bruner (1986) who emphasized that asking and investigating questions through the richness of story allows access to the complexity of problems that lie at the heart of teaching. Exploring and documenting practice in this manner contributes to a “scholarship of teaching” (Boyer, 1990) that not only adds to a base of knowledge, but enriches and extends it as well (Lyons & LaBoskey, 2002). Thus, capturing and representing teacher conceptions of social capital as “scholarship”, as adding to the body of knowledge, requires that teacher ideas are shared publicly, are subject to critical review from peers and others outside of their community, and are able to be shared, discussed and exchanged by other professionals (Shulman, 1998). Use of narrative inquiry to capture the nuances and taken-for-granted decisions teachers make as they examine their practice allowed shared teacher knowledge to define dimensions that were
“testably valid” (Lyons & LaBoskey, 2002, p 5) and open to intellectual deliberation (Schon, 1995).

Uncovering these group stories allowed for the facilitation of a “narrative authority” (Olson & Craig, 2001) that comes from the accounting of collective professional practical knowledge (Connelly & Clandinin, 1988). In this manner, I privileged teacher narratives as a principal source of expression of teachers’ social environments, a repository that served as both a “central medium of cultural expression, organization and learning” (Cortazzi, 1993, p 101) and as a creator of cultural contexts (Cortazzi, 1993). I viewed these shared accounts as a way to “capture group and cultural consciousness” (Polyani, 1985) and thus a window into a collective’s definition of the constructs of “social capital.”

**Narrative data collection.** Teachers, who had been grouped into five dyads/triads based on quantitative social network analysis (Phase 1 of the study), were asked to interview one another. This research design feature attended to issues around validity: treatment of the researched as equal partners in the study, allowing participants to give their own interpretations of data in the study, and allowing for the researcher to examine and change her own preconceived ideas brought into the study. My role in this phase was both as an insider to the research process (as the one posing the initial questions, and as one who had been involved in their weekly professional development conversations) and as an outsider (as an observing non-participant of the interview). In the role of participant/observer, I explained that I would possibly be interjecting additional questions in order to clarify meaning, or to allow the participants to expand on a particular line of
thought. This did occur during the interviews at times when I needed further explanation, when the conversation had strayed off-topic, or if I was cognizant of the time and wanted to assure that teachers had a chance to address each question.

Semi-structured interviews were designed in such a way to elicit narratives or common stories about their experiences as professional learners. Four of the interviews took place at the school, in either teacher classrooms or in the library. The fifth interview occurred at a coffee shop near the high school. Teachers were informed that the purpose of the research was to study, from their perspective, what resources they needed in order to be successful in their work and how they go about gaining access to those resources. Participants were presented with the following set of questions and instructed that they could start with any question they chose, and were asked to allow both (or all 3) teachers to have a chance to ask and respond to each question (in other words, turn-taking in developing the narrative was emphasized):

- Talk about a time when you had to change something about your teaching. What happened? Who or what helped you with this?
- Talk about a time when you felt that you needed help with your teaching (a time when you were frustrated, in “new territory”, or experienced tension, possibly). What did you do? What resources did you have to help you (people, ideas, books, websites, etc)?
- What resources do you wish you had to help you as you try to improve or change your teaching? Explain.
- Whom do you consider to have “expert knowledge” in your department? Why, and what is that person knowledgeable in?

- As you prepared for the “Research Lesson” in May, what resources did you use to help you make sense of the mathematics in the lesson? What resources did you use to help you make decisions about how to teach the lesson?

- Did participation in the “Research Lesson” in May change your ideas about how you might seek help from others in your department? If so, in what way?

- Did participation in the Research Lesson change your ideas about how you might seek help from resources outside of your department (including texts, other people, both in the building/district and outside of the district, other sources of information or knowledge that you needed)? If so, in what way?

The five interviews conducted lasted between 41 minutes and 106 minutes. The interviews were audio-taped, and then transcribed and transferred into nVivo for coding and analysis. Additional quantitative and qualitative analysis on the categorical data gathered was conducted using Excel software, and charts were created using Many Eyes software (http://www-958.ibm.com/software/data/cognos/manyeyes/visualizations). A coding scheme which identified the interview number (1 – 5) and the segment of text in the interview (parsed according to row numbers assigned in nVivo to portions of transcripts) was employed to facilitate cross-referencing, text searches and access to data.
Additional data sources. Throughout the two years of the larger study/project (which included my preliminary study and my main dissertation study), field notes were taken at group meetings (professional development sessions, department meetings and school staff meetings), and memos written at key junctures to capture researcher impressions, ideas and potential researcher bias. My past experiences with teacher groups at other sites (including one high school math group that was particularly conflict-ridden) were carefully weighed and acknowledged (Rubin & Rubin, 2005). Artifacts from meetings and professional development sessions, including agendas, notes from posters and group work, were collected. I also gathered newspaper articles, school newsletters, memos from administrators, and past state reports in order to gain access to additional and potentially useful data.

Additionally, I administered a brief survey using a pre- and post-design, asking identical questions both before the start of the larger study in Summer 2010, and at the completion of the 2nd year of the larger study in Summer 2012. Teachers were asked to answer the following questions:

1. Please write in 1 or 2 sentences what you feel best describes the shared vision of the West HS Math Dept. (What does the department value?)

2. Please write in 1 or 2 sentences a description of how you feel the West HS Math Dept communicates with one another and with those outside of the department.

3. What do you feel best describes what the department believes about mathematics teaching and learning?
Teachers were anonymous in this portion of the study, matched in their pre-post responses using their mother’s maiden name. This data was analyzed and compared to the interview and social network data to identify and confirm discourse and communication patterns around potential collective definitions of social capital.

**Narrative data analysis.**

*Identification of “narrative arcs” and orientation/evaluation phases of each narrative.* With a large amount of data to analyze, and no one established method to do so (Riessman, 1993), there is space allowed for how one chooses to go about “interpreting (subjects’) interpretations” (Riessman, 1993, p. 5). Analyzing discourse patterns to detect shared interpretations is one way to sift through narratives in order to identify intended cultural meaning (Labov, 1972). Labov’s discourse analysis model (Labov, 1972; Cortazzi, 1993) is a sociolinguistic approach which is well-suited to detecting teacher individual and collective conceptions of social capital. The model analyzes the structural properties of narratives in relation to their social purpose by separation into the following phases or stages (Table 3):
Table 3: *Labov’s Stages of Narratives*

<table>
<thead>
<tr>
<th>Stages</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>initiates the narrative, a general proposition; may or may not be present in a narrative</td>
</tr>
<tr>
<td>Orientation</td>
<td>the setting; who/what/when/where of events</td>
</tr>
<tr>
<td>Complication</td>
<td>the event, what happened, usually a series of narrative clauses in past simple tense</td>
</tr>
<tr>
<td>Evaluation</td>
<td>often precedes the result, answers the ‘so what”, conveys the importance of the event and the story</td>
</tr>
<tr>
<td>Result</td>
<td>resolution to the conflict</td>
</tr>
<tr>
<td>Coda</td>
<td>returns listeners to present moment (e.g., “that was it”), may or may not be present</td>
</tr>
</tbody>
</table>

Cortazzi’s (1993) analysis of British primary teachers’ perceptions of their work focused specifically on the Orientation and Evaluation phases of teacher stories, claiming that it is in the central components of the setting (Orientation) as well as in the “so what” of the story (Evaluation) where shared social meaning is revealed. Additionally, how teachers interact with one another, as well as with elements of the story (what Cortazzi called “the balance between referential and social meaning” [Cortazzi, 1993, p. 115]), reveals important information about group professional and cultural identity. Therefore, coding of the narrative data first focused on identifying what I called “narrative arcs” in their conversations together: the beginnings, flow-through and endings of their shared accounts. This analysis yielded a total of 114 narrative segments, which were then further analyzed and coded to detect patterns.

A first example of a narrative arc occurred in Interview 2. The two teachers in the interview pair had co-taught together for several years in an inclusion classroom setting. Char was a general education, mathematics-certified teacher; Ev was a special education teacher (who taught both inclusion classes and pull-out mathematics classes by himself for students on Individual Education Plans). The conversation began as Char posed the
2nd question on the list to Ev:”talk about a time when you had to change something about your teaching… who helped you?” Ev shared how he relied often on Char for help when he had to figure out mathematics problems: “there’ve been times when I don’t understand a concept because I’m not a math person and I’ll go to you and say ‘how do you do this? What does this exactly mean?’” (2:2) He continues with his explanation, speaking directly to Char. The teachers maintained eye contact throughout the interview and faced each other as they talked, often nodding in agreement. I interjected a clarifying question, asking why it’s Char he goes to for this help rather than others in the department: “there’s a couple math teachers that have a lot of content knowledge but they aren’t good at breaking it down to someone like me. Well, (Char) is good at breaking it down so I can understand it.” (2:3) Char then answers the same question, extending the narrative with the phrase “to kind of add on to what you’re talking about…”, describing how Ev has helped her to pay attention to the attributes of tests that impact students, like size of the font and spacing on the page as “things that I never thought about when I first started teaching” and summarizing the story with “that was something that I think working with you has really made a difference” (2:4). The conversation then shifted to the topic of identifying people they go to for help when they are faced with deadlines or tension. I coded this sequence as one narrative arc, which lasted 284 seconds (or 4.7 minutes). I noted in a follow-up memo how the story had been told by the teachers jointly, using “I” and “you” statements to build the narrative

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1 Citations of teacher conversations indicate interview number and segment number from the transcript. Teacher references to “you” indicate one teacher addressing another teacher in their interview group, not a reference to the author. Slash marks in interviews indicate a change in speaker from one teacher to another.
together, often nodding in agreement at the statements each other, maintaining eye contact, then ending with “so that’s why…” or moving on to another question.

In another example, two teachers in Interview 3 are discussing teacher leadership roles in the building and how they are enacted, when the conversation shifted to their perceptions and experiences of how teachers are treated by administrators in the building:

1 Sam: They just…they have the same concerns that we have, and it’s like…it’s another personal voice, too, when they voice to us…so sometimes they will approach us because that’s their way of speaking to the administration without actually going. It’s like a security blanket.
2 Lee: Oh, yeah, yeah, yeah, yeah.
3 Sam: Because one of us will deliver the message or will, you know.
4 Lee: At least ask the question if we (inaudible).
5 Sam: Yeah, even though we’ll probably get snapped at because…
6 Lee: Right.
7 Sam: That usually happens.
8 Lee: On a regular basis.
9 Sam: So, I always just sit there and smile after I ask it. (3:63, 64)

I note in my memo how this teacher pair had also maintained eye contact and nodded in agreement with one another, and also how they often finished each other’s sentences or completed stories by adding details (as in lines 3-8 above). In this example, I coded the narrative as beginning with line 5 and continuing on for 6.7 minutes (403 seconds). Also noted here was this teacher pair’s sense of frustration with building leadership and how they shared other “like” events to reinforce their main storyline (Webster & Mertova, 2007).

Transcripts were read and listened to using nVivo software, and coded to detect the narrative segments as shown in the above examples. This data was then translated
into a spreadsheet in order to facilitate further analysis. For example, the narrative segment from Interview 3 above was entered into the spreadsheet as follows:

Table 4: Sample Data Record of Narrative Segment

<table>
<thead>
<tr>
<th>Narrative arc</th>
<th>Total Min</th>
<th>Theme</th>
<th>Teacher Narrative</th>
<th>Transcript Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>55.57-62.00</td>
<td>6.7</td>
<td>Lack of trust between admin and teachers. Micromanagement by admin.</td>
<td>even though we’ll probably get snapped at because.-Right. -That usually happens.- on a regular basis.__ we are belittled at times where we can’t make a decision on our own when, even though it’s the better…it’s for the mass. So, that can be very frustrating.___they micromanage everything</td>
<td>64, 65, 66, 67</td>
</tr>
</tbody>
</table>

Each narrative segment was entered with the time stamp so that time lengths could be calculated. Summary statements were included from the transcripts so as not to lose the context, inflection or flow of key ideas (Riessman, 1993), and main themes of the narrative were noted.

After this initial coding of the transcripts to detect where narratives began and ended, analysis centered on detecting stages in the stories told, with a particular focus on events or elements interpreted as belonging to the Orientation or Evaluation stage. Cortazzi (1993) claimed that these phases of narrative, in particular, described these events as central to teachers’ professional identity in that they portrayed the importance of the event itself (in its setting – the Orientation) and in the meaning of the event (the “what for” or Evaluation). Using this “Evaluation Model” allowed for detection of evidence of shared meaning and experiences, which in turn facilitated examination of
teachers’ cultural definitions and perspectives. This focus paid heed to what Cortazzi called “the balance between referential and social meaning” wherein “part of the social meaning will reside in the tellers’ reactions both to the *narrative* and to the *narration* and its performance; and in the *interaction* between those present during the narration” (Cortazzi, 1993, p. 116, italics original).

An example illustrates how the coding proceeded to identify phases in each of the narrative arcs:

**Abstract:** So, the communication…

**Orientation:** I did teach at one other school for a year, and that was not the thing. You had to be in rows. You had to…no talking. You had to look straight ahead…

**Complication:** (but) there were so many different changes…it’s overwhelming…

**Evaluation:** some of the older teachers just get like, well, this is what’s worked for me in the past and I’m just going to close the door and …If you wait long enough, it’s going to go away, right?

**Result:** Eventually it’s going to work its way back around and it’s going to be the same old thing in the past…

**Coda:** so…

In this segment, one teacher is relaying a perspective about the changes which have occurred in the district over the years. The segment, which spans about 43 seconds, shows the teacher setting up the story and then also ending it with “so”, a narrative device which signals the start of a narrative, and then a conclusion by returning listeners to the present moment (Cortazzi, 1993). The Orientation phase here gives details as to the background needed (that this teacher used to be in a different setting with different expectations) in order to understand the main point of the story (the Evaluation – that many teachers just decide to forgo making the changes expected of them). The
Complication portion here informs the listener of the changes expected of teachers now in their building and that teachers there are often overwhelmed.

As pointed out by Riessmann (1993), most narratives are not structured so cleanly, containing multiple entry points into a story which may or may not fit the framework outlined above. I used the narrative arcs to identify how the teacher(s) conveyed their meaning, how they oriented me to the story’s background (Orientation), what they considered to be the main issue or problem under consideration (Complication), and then summarizing statements they made that defined the “so what” of their story (Evaluation). These statements were recorded in the spreadsheet under the column entitled “Teacher Narrative”. Subsequently, this column was re-titled “Teacher Evaluation Statements.” For example, the phrases “that was something that I think working with you has really made a difference” (2:4) and “we are belittled at times where we can’t make a decision on our own when, even though …it’s for the mass. So, that can be very frustrating …they micromanage everything” (3:64-67) both connect the listener to the experiences of the tellers, the emotion they felt, and why that episode was a defining one for them.

Open and axial coding of the narrative story arcs to identify network actors/nodes. Once the narrative arcs were identified, including the Orientation and Evaluation statements contained in them, the analysis process then involved iterative phases of coding and re-coding, looking for further nuances in the data, using Maxwell’s (2005) approach of categorizing then connecting, moving back and forth between previously detected and emergent patterns (as opposed to looking for a specific theme).
I was looking here for the individuals which teachers in this group identified as the most important to their network – the “nodes” or “actors” with whom they most often interacted in their professional school lives. Open coding (Glaser & Strauss, 1967/2007) proceeded to detect broad categories within the narratives and for similarities in their interpretations of events. Initial categories here included, for example, technology, peer teachers, administrator concerns, student concerns, outside resources and textbooks. Analytic memos (Schram, 2006) written to “identify a central idea or concept” were instrumental in this process and afforded me spaces to address my relationship with the group and this work, to be able to acknowledge the “reflexivity” (Schwandt, 2007) and subjectivity (Peshkin, 1988) inherent in my role as participant observer.

Using the constant comparative method (Glaser and Strauss, 1967/2007), I returned to the literature base, read additional studies, refined my understanding of the theoretical models of social capital, and re-read and compared multiple narrative arcs in the teacher stories to detect cross-cutting themes and patterns. This axial coding phase (Glaser & Strauss, 1967/2007) led to more nuanced interpretation and connections amongst the narratives and the theoretical models. Teacher “Orientation” statements often identified persons whom they sought out for professional advice, and these categories became the nodes (or individual actors) of their social capital network (the beginning framework to answer my Research Question #2). These categories included peer teachers, administrators, external resources (such as university professors or teachers in other districts) and themselves.
**Affordances and inhibitors to professional growth.** As I examined the narrative arcs for their overall tone, I initially coded narratives looking for “inhibitors” or “affordances” to teacher professional learning (my Research Question #1) based on direct teacher statements. When teachers in Interview 1 talked about another teacher in the department who, due to his location in the building, had no one to help him to learn new technology (1: 24), my initial coding was “inhibitor” for this passage. Using nVivo, I was then able to analyze passages using multiple codes and then search for overlaps in those codes (Bazeley, 2007).

I created a query in the software to look for examples of when I had coded passages as “inhibitor” and “technology” in order to see how teachers stories around how they aren’t close to others in the building (physical proximity) to be able to consult for help were negative stories for them. However, these statements were often discussed in terms of something they needed that was missing – elements I came to see as “affordances” in helping them to gain access to resources or to increase their social capital. So, although categorized by them as a learning constraint for the department, the element in this case was re-coded as an affordance overall. These codes were seen as further evidence that certain elements were affordances (e.g., proximity of rooms) when the negative case was identified by teachers as an inhibitor.

Another example of this level of axial coding and my interpreting teacher stories in terms of “institutional discourses” (Riessmann, 1993, p. 61) were narratives where several interviews identified the negative aspects of a reform effort that they were involved in, such as the requirement to write course common assessments. While many
teachers raised legitimate questions about the purpose and nature of the directive, others admitted that the work had caused them to be “much more focused as a department” and that they were, as a group, much more “on the same page” as far as expectations of students, etc. (5:21). Since I was looking for descriptions of teacher experiences accessing social capital in order to help them grow professionally, these passages were re-coded as affordances. This coding scheme was helpful in explaining, for example, that there were more minutes in Interview 4 spent discussing “administration” than there were discussing “math peers.” This data was in contrast to data from the other four interviews where the teacher pairs spent most of their time discussing their peers within the department. Once I was able to see that the teachers in Interview 4 followed a narrative that was critical of the administration, the coding of this data as “inhibitor” was more revealing overall.

*Combining themes/evaluation statements into critical and like events.* In one memo during this phase of data analysis, I wrote: “As I reread and recode, I'm seeing how the flow of the narratives gives more depth and texture to the stories, how it makes some stand out in ways that others don’t... and how some stories, told over and over, take on greater meaning.” I analyzed this phenomenon, what Cortazzi (1993) saw as convergence around a central theme, using “critical event analysis” in which stories were sorted according to three categories: “critical”, “like” and “other” (Webster & Mertova, 2007). First acknowledged by Wood (1993), critical events are those that challenge teachers’ beliefs about teaching and are often characterized by intensified events that confirm certain personal claims and may “emphatically” reject others. In data analysis,
the descriptions or stories appear as distinctive and illustrative of a larger idea, often repeated by others or observed during data collection.

“Like” events are those that are shared as confirming or verifying the critical event – something that happens to authenticate the importance of the critical narrative. “Other” events are those that occur alongside or at the same time as critical or like events, are anecdotal or incidental, and reveal similar issues as critical and like events. “Other” events, for example, might take place in hallway or parking lot conversations as discussions or expansions of those issues that are experienced as more central. The Peer Observation Lesson, targeted in my Research Question #3, is an example of an event that I classified as “critical” using the model’s definitions, as shown below in Table 5:

Table 5: **Classification of Events as Critical, Like or Other**

<table>
<thead>
<tr>
<th>Narrative Arc/Theme</th>
<th>Teacher “Evaluation” Statement</th>
<th>Critical/Like/Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer Lesson</td>
<td>The really big thing I got out of it was the differentiation between two classes, the way that lesson was adapted to meet the needs of each set of students... the research lessons are good. I like seeing what other people do. It does help me come up with different ways to do things, you know. (1:50)</td>
<td>Critical (seeing lessons adapted; helped teacher reflect, change instruction)</td>
</tr>
<tr>
<td>Peer Lesson</td>
<td>I learned a lot because I didn’t…I sometimes don’t give my kids enough…I’m afraid of giving them too much, so I don’t give them enough support. So then, they’re really struggling too much, maybe to the point where they’ll give up. So, then watching Sam, I thought, you know what? I am going to do a little more review than I had actually planned. (1:52, 56)</td>
<td>Like (caused self-reflection and change in instruction)</td>
</tr>
<tr>
<td>Peer Lesson</td>
<td>I think that each lesson was really unique, each teacher handled it very differently and that was interesting to observe...Lou really did a great lesson plan I thought that day (2: 20, 23)</td>
<td>Like (seeing strengths of other teachers)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Peer Lesson</td>
<td>I got to get out of my classroom and see other teachers in action...to know you’re not the only one that’s struggling ___when I watched Pat’s class, you know, for me, it was like, okay I do need to take a step back. I do have to put a little bit more in (students’) hands, you know? (3:42, 43)</td>
<td>Like (caused self-reflection and change in instruction)</td>
</tr>
<tr>
<td>Peer Lesson</td>
<td>I said our focus was not in there to really observe the other teacher. We went in there to observe the students in that teacher's class. ...My students struggled with the same thing that his students struggled with...we got to talk after each class (4:20, 21).</td>
<td>Like (opportunity to share professionally)</td>
</tr>
<tr>
<td>Peer Lesson</td>
<td>It was very eye-opening. It lets you just see, you know, because everybody teaches different...Everybody does teach different. Everybody has their own way...(5:38)</td>
<td>Like (seeing different types/levels of expertise)</td>
</tr>
</tbody>
</table>

Although the Peer Observation Lesson would most likely not be called “life-changing” by the teachers or the researcher (as characterized by Woods, 1993), the convergence of stories around this one event (and others) helped to shed light on the components of their teaching lives which strong-tie teacher pairs considered to impact their professional growth. These events can lead to a sense of unity within the group, a collaborative culture with similar and deeply-held values, goals, aspirations.

**Discrepant case analysis.** Finally, this axial, iterative phase of data analysis also allowed for a focus on teacher discussions around what they didn’t know, a perspective which provided a window into what teachers considered critical questions in their
practice (Richert, 2002). These were additional important insights that revealed what lies under the surface for teachers when it comes to identifying social capital. Likewise, examining transcripts for discrepant cases (a version of Erickson’s (1986) “negative case analysis”), or evidence of issues and elements which teachers did not discuss, led to additional insights into their beliefs about resources needed for professional growth.

**Trustworthiness**

In qualitative research, validity is defined as “trustworthiness” and “transparency” of the process (Rubin and Rubin, 2005), and can be assured through prolonged exposure to the research site (breadth) and persistent observations (depth) (Lincoln & Guba, 1985). As a Research Assistant for the Mathematics Project which took place alongside this dissertation study, I was fortunate to be able to participate in all of the summer professional development for teachers (a total of 14 days over 2 summers), most of the weekly morning teacher meetings over 2 years of the project, the monthly extended professional development time during district Early Release days, the Peer Observation lessons, and planning meetings with district administrators (see Table 6, Timeline for the Study). This involvement with the research process provided extended experiences with the teachers, both in their planning meetings and within their classrooms, and allowed for dense and detailed observations in the form of analytic memos. These observations were used as additional sources of data, as were teacher written reflections before and after Year One of the project, to allow for multiple checks for trustworthiness.

Extended involvement with the group also helped to establish trust with the teachers so that their narrative accounts would be plausible (Riessman, 2003).
Plausibility and trust were central considerations in the research design, which used social network analysis (based on teacher input) to create strong-tie, high-trust pairs who then interviewed one another. In this way, teacher voices and stories guided the analysis from the researcher, and were balanced with negative case analysis (Erickson, 1986), which examined those issues that teachers did not discuss. Finally, the use of a critical events model for identifying central threads in the narrative assured verisimilitude and authenticity (Webster & Mertova, 2007) of the findings.

**Timeline for the Study**

**Table 6: Timeline for the Study**

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original grant awarded for Year One of MSU Math Project; beginning of planning with district administrators</td>
<td>Spring – Summer 2010</td>
</tr>
<tr>
<td>Initial meetings with teachers – Dinner; 5 days of professional development</td>
<td>Summer 2010</td>
</tr>
<tr>
<td>Koebley preliminary study data collection and analysis; weekly meetings with teachers; monthly extended meetings during their “Early Release” professional development time; Peer Observation Lessons</td>
<td>Fall and Spring – 2010 – 2011</td>
</tr>
<tr>
<td>Proposal for Koebley dissertation study and IRB approval</td>
<td>June 2011</td>
</tr>
<tr>
<td>Quantitative data collection; teacher pairs/triads established for interviews</td>
<td>Summer 2011</td>
</tr>
<tr>
<td>Year Two of MSU Math Project awarded; 5 days of professional development with teachers</td>
<td>August 2011</td>
</tr>
<tr>
<td>Weekly meetings with teachers; monthly extended meetings during their “Early Release” professional development time; Peer Observation Lessons</td>
<td>Fall 2011 – Spring 2012</td>
</tr>
<tr>
<td>Event</td>
<td>Date</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Teacher interviews for dissertation study</td>
<td>Winter 2011</td>
</tr>
<tr>
<td>Data transcription and analysis</td>
<td>Spring/Summer 2012</td>
</tr>
<tr>
<td>2 days of professional development with teachers</td>
<td>Summer 2012</td>
</tr>
<tr>
<td>Dissertation defense</td>
<td>Fall 2012</td>
</tr>
</tbody>
</table>
CHAPTER IV

RESULTS

Quantitative results are presented below as Phase I of the study, in which teacher pairs were determined using social network analysis. Phase II incorporates the qualitative data from teachers’ interviews of one another about how they gain access to resources to improve their teaching, and whom they consider to be contributors or inhibitors to their professional growth.

Phase I – Social Network Analysis to Detect Strong-Tie Groups for Interviews

The initial phase employed quantitative methods from social network analysis (Ibarra, 2003) in order to determine teacher dyads for semi-structured interviews (Rubin, 2005).

Raw Data Matrix Input

Teachers were asked to complete an online survey which asked the following questions (adapted from Moolenaar, et al., 2010):

1. Who are the 3 people in the department you consulted the most often for professional advice (something about your teaching, your students, etc)?

2. Who are the 3 people in the department who came to you for professional advice the most often?
All 14 teachers in the department responded to Question #1, while only 10 teachers responded to Question 2. Since data for the 2nd question was incomplete, the department’s network analysis used only data from Question 1. Teacher responses were entered into a matrix indicating which teachers contacted whom for advice. The 14 x 14 matrix (14 rows and 14 columns) shown in Table 7 below is a representation in which each row and column corresponds to a teacher respondent. Row headings indicate the initiator of the contact, or who asked for professional help, while column headings indicate the recipient, or to whom the request for help was directed.

Teachers were randomly assigned names that were gender-neutral in order to protect their identities. Similarly, discussions of teacher interviews and data alternate the use of the pronouns “he” and “she” for each citation.

The data were entered into the UCINET software (freeware from Borgatti, Everett & Freeman, 2002) in binary format (1 for “asked for help”, 0 for “did not ask for help”). If teachers had been asked to rank their associations with other teachers (e.g., “name the top three teachers you contacted for professional help in order of preference”, etc), weighted data could have been used. In this case, since the purpose was not to analyze the network, but to uncover strong-tie combinations between teachers and professionally connected clique sub-groups, the statistics from binary data were sufficient.
The matrix was asymmetric, meaning that the recipients of requests for help did not always ask their requestors for help in return.
Visualizing the Data

Matrix data were plotted using NetDraw software to create the network graph shown in Figure 5:

![Social Network Graph of West High Mathematics Department](image)

**Figure 5:** Social Network Graph of West High Mathematics Department

The points or nodes in this graph represent individual teachers in the West High Mathematics Department who exchanged professional information among themselves\(^2\).

Directional arrows indicate the initiator of the exchange and to whom the request was directed. In the diagram above, for example, the Sid → Char element of the graph

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\(^2\) The term “nodes” is used here to indicate the teachers in an already-identified network, that of the Mathematics Department. Later in the study, the term is used to identify the key individuals or actors in the teachers’ larger professional network, which extended beyond just their department.
indicates that Sid sought out Char for professional advice. However, since the arrow flows in only one direction, the graph shows that Char did not request advice from Sid.

The directional graph allowed for a first glance at the makeup and cohesion of this network of teachers, and an intuitive initial analysis of the features of the group. Multiple arrows to and from particular teachers indicated a large number of connections within the group for some teachers, whereas other individuals, such as Sid, were more isolated, indicating fewer connections within the teacher network. Another way of interpreting this was to say that some teacher connections were more likely to be reciprocated (Hanneman & Riddle, 2005), indicated by bi-directional arrows and interpreted as a higher degree of connectedness within the group, whereas others were less likely to have multiple connections and were seen as having more distance from the rest of the group.

The distance between the teachers or nodes can also be addressed here. An algorithm included in the software allowed for multi-dimensional scaling of the data, which interpreted how closely connected each of the group members were to one another. Through statistical analysis of who asked whom for advice, the distances between teachers and groups of teachers could be quantified and visualized. Shorter line distances, and teachers clustered together, indicated shorter paths between two teachers, which were in turn interpreted as more cohesion or stronger ties between certain group members. Longer paths between teachers represented less cohesion or connectivity around teacher professional advice.
During this initial examination of the visual data, groups of actors emerged from the graph, specifically Pat-Mel-Les and Ev-Char-Kelly. Teachers within these groups each reciprocated the requests for advice, as demonstrated by the directional arrows, and as the triads clustered together on the network graph. Additionally, it was noted that some teacher groups were more centrally located (Sam-Lee-Nicky) while others were located more on the periphery (Pat-Mel-Les) of the group. The sub-group of Sam-Lee-Nicky is seen to include members of several other groupings and serve to connect the other sub-groups via their co-membership in multiple groupings (Hanneman & Riddle, 2005).

**Further Data Analysis to Identify Cliques**

After the initial intuitive analysis of the directional social network graph, additional statistical tests were run to confirm which teacher groups or pairs were the most cohesive, or strongest tied. At this point in the study, one teacher, Alex, had left the district, so interview pairs would not include her. This data was removed from the data set. Statistical routines revealed “cliques” among the teacher network – strong tie groups (dyads or triads) interpreted as a subsets of teachers in which the “actors are more closely and intensely tied to one another than they are to other members of the network” (Hanneman & Riddle, 2005). This method identifies a clique when each member has a reciprocal tie to each other member, and it identifies the largest such groupings. The algorithm detected seven cliques in the network, listed below in Table 8.
Table 8: *Cliques Detected in West High Mathematics Department Teacher Network*

1: Nicky – Sam - Lee  
2: Nicky - Lou  
3: Mel- Pat - Les  
4: Chris - Andi  
5: Andi - Lee  
6: Kelly - Ev  
7: Char - Ev

Specific definitions of groupings of teachers will produce different identifications of “cliques”. Since this data was asymmetric, “strong” or “weak” cliques could be identified. Focusing on “strong cliques” was a reasonable assumption for the purpose of finding teacher “strong ties” (Hanneman, 2012).

Running the UCINET algorithm “Network>Subgroups>Cliques” produced this census of all cliques present in the teacher network, and included a measure of how each teacher group (or clique) overlapped with other groups. The additional statistics generated by this routine (in Table 9 below) indicated how "adjacent" each actor (row) is to each clique (column). Chris, for example, is adjacent to 1/2 of the members of clique 5, while Sid is shown to be an isolate, or not a member or any cliques in the group. Lee is seen as the “most connected” member of the group, overlapping with 4 cliques. This data is also visible in the original network diagram in Figure 5.
Table 9: Clique Participation Score

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tr>
<td>Chris</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
<td>0.50</td>
<td>0.00</td>
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</tr>
<tr>
<td>Mel</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Pat</td>
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<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Nicky</td>
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<td>0.00</td>
<td>0.50</td>
<td>0.00</td>
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</tr>
<tr>
<td>Lou</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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</tr>
<tr>
<td>Les</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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</tr>
<tr>
<td>Sid</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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</tr>
<tr>
<td>Andi</td>
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<td>Sam</td>
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<td>0.00</td>
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</tr>
<tr>
<td>Kelly</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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</tr>
<tr>
<td>Lee</td>
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<td>0.00</td>
<td>0.50</td>
<td>1.00</td>
<td>0.00</td>
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<tr>
<td>Char</td>
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<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.50</td>
<td>1.00</td>
</tr>
<tr>
<td>Ev</td>
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<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Clique data generated from the algorithm were graphed to create a tree diagram (Figure 6), providing a visual indication of which teachers within the department clustered together around professional advice.
The statistical routine which created the tree diagram above clusters actors according to the frequency of their pairwise group membership, or in other words, how often teacher identifications of one another as professional advice-seekers overlapped with other clusters of teachers who sought advice. Sid, for example, is seen as not overlapping with any other actors in the group. This is in agreement with data discussed previously indicating that Sid was an “isolate”, or a teacher whom no other teacher identified as one from whom they sought advice. By contrast, Mel, Pat and Les are seen as strongly clustered, with no overlaps with other identified clusters. This is a result of each of those
3 teachers identifying the other 2 as teachers from whom they sought professional help (also indicated in Table 9 as each teacher having 100% agreement within Clique #3, or the 3rd column). The branching “trunks” of the remaining clusters indicate that the remaining cliques of teachers had considerable overlap. Ev is seen as a “bridge” between Char and Kelly, meaning that Char and Kelly both sought out Ev for advice, yet didn’t seek one another out directly. As Ev indicated that he reciprocated in advice-seeking from Char and Kelly (as indicated in matrix in Table 7 and social network graph in Figure 5), the Char-Kelly-Ev clique was identified.

Using the Data to Create Interview Groups

From this data, the following groups emerged as the most cohesive cliques:

1. Mel-Pat-Les
2. Nicky-Lou
3. Chris-Andi
4. Sam-Lee
5. Char-Kelly-Ev

Sid was one teacher which no other teacher had named as someone from whom they had requested professional advice, and thus needed consideration in placing her for an interview. Additionally, a second teacher left the district at this point, Andi. Chris had been paired with Andi, so was left without a partner. Chris had been named by Sid, so although one-directional, it indicated that information had been requested and shared, even if in a one-way manner. Thus Chris-Sid were matched as interview partners.
The Nicky-Lou pair was considered and was a concern, as one of the pair had not strongly indicated that she would participate in the interview portion of the study. For this reason, and because Kelly had indicated both of these teachers as ones whom he had contacted for professional help, Kelly was placed with Nicky-Lou to create a triad for the interview portion. Additionally, this created a group in which 2 of the 3 teachers were special education teachers. The decision proved fortuitous, as one teacher did leave the interview early, and having a triad allowed the data collection to continue. This interview, in particular, yielded valuable data, as the viewpoint of special education teachers was allowed to emerge.

**Final Interview Pairs/Triads**

This data revealed that the pairs/triads listed below were those in the teacher network with the most cohesion and strongest-ties around teacher professional advice, and set the stage for the interviews.

1. Mel-Pat-Les
2. Char-Ev
3. Lee-Sam
4. Nicky-Lou-Kelly
5. Chris-Sid

This phase of data analysis defined teachers who were connected to one another in strong-tie groups based on whom they sought out for professional advice. The use of network analysis statistical routines also led to the identification of how teacher groups, or cliques, overlapped with one another, or how connected each clique was to the larger
teacher network. Visualization of these relationships using network graphs helped to define and confirm the assignment of teachers to high-trust interview pairs. This design feature of the study allowed me to utilize aspects of the group’s social capital (who the actors are in the network and how strongly tied they are to one another) to be able to gain access to cohesive narratives told by pairs or triads who had high levels of trust in one another.

**Phase II – Qualitative Narrative Analysis of Teacher Interview Data**

Since social capital can be visualized as a network of actors or nodes (individuals, teachers, administrators or others) who are linked or connected through a series of ties (Wellman & Wortley, 1990), relationships (Coleman, 1988) or communication patterns (Adams, 2000), coding of teacher narratives first sought to detect teacher perceptions of who comprised their main professional network (the nodes), and then how they perceived the actors/nodes to be connected to one another (connectors).

**Identification of Actors/Nodes as Purveyors of Social Capital**

Whom did the teachers in the study consider to be most important as they sought professional help or advice? Teacher responses were coded according to whom they designated as the individuals they interacted with as they sought professional assistance. Total minutes discussed in five interviews for each category are represented in Table 10:
Table 10: *Number of Minutes Teachers Discussed Categories of Social Network Nodes*

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Minutes Discussed (% of total minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer Math Teachers (within their department)</td>
<td>235 (59%)</td>
</tr>
<tr>
<td>Administrators (building and district level)</td>
<td>96.7 (24%)</td>
</tr>
<tr>
<td>Self (relied on their own knowledge)</td>
<td>55.5 (14%)</td>
</tr>
<tr>
<td>Peer Teachers (within their building, other departments)</td>
<td>47.3 (12%)</td>
</tr>
<tr>
<td>External Sources (teachers, professors, etc, outside of their district)</td>
<td>36.3 (9%)</td>
</tr>
</tbody>
</table>

The five interviews together totaled 398.3 minutes. Percentages in Table 10 above indicate the percent of the total interview time during which teachers discussed the category. Percents do not add up to 100% due to the incidence of some passages being coded in multiple categories.

This same data is visualized in Figure 7 using a circle graph in which each category is represented by a circle whose diameter is proportional to the number of minutes spent discussing the category.
Figure 7: Number of Minutes Teachers Discussed Social Network Nodes By Category

In Figure 8, the data is further delineated by interview, with each circle’s diameter representing the number of minutes spent in each interview discussing the nodes or actors of their social network.
Coding also tracked whether the context of the narrative referred to the actor/node as one who helped with (affordance) or hindered (inhibitor) teacher professional growth. I defined "inhibitor" as an element in their social network that hindered teachers’ professional learning, whereas "affordances" provided access to social capital resources which in turn allowed opportunities for professional growth.
Table 11: Number of References in Interviews to Actors/Nodes as Affordances or Inhibitors to Professional Growth

<table>
<thead>
<tr>
<th>Actor/Node Categories*</th>
<th>Affordances</th>
<th>Inhibitors</th>
<th>Total References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer Teachers (within Math Dept)</td>
<td>153</td>
<td>26</td>
<td>179</td>
</tr>
<tr>
<td>Peer Teachers (in building)</td>
<td>17</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>Administrators</td>
<td>9</td>
<td>49</td>
<td>58</td>
</tr>
<tr>
<td>External Sources</td>
<td>30</td>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>

*"Self" category was not coded as “affordance” or “inhibitor”.

Data coding in this manner revealed patterns of teacher dispositions towards their own professional growth and allowed for further insight into the categories and situations which teachers felt were important to their own learning. As discussed in Chapter 3, “affordances” included occurrences when some teachers may have discussed an event or actor as an inhibitor (e.g., Teacher B in Interview 4 expressing frustration at administrator directives which required writing common assessments), but others stated clearly that the same event/actor led to professional growth on some level (e.g., Chris in Interview 5.
saying that “the common assessment has helped to bring more focus to the department” and that they are more on the “same page” now as a group [5:21]).

Elaboration of each of the categories coded as actors/nodes follows.

Peer math teachers (within the West High Mathematics Department). Peer teachers from within the West High Mathematics Department were the actor/nodes most often discussed as those whom the mathematics teachers consulted when they were seeking professional guidance. Out of a total of 472 minutes in the interviews which were coded for “node/actor” discussions, 235 minutes (50%) were spent addressing teachers’ reliance on one another within the department. Of the total 179 instances (or narrative fragments) that were coded as discussing peer math teachers, 153 (85%) of these passages referred to their peer math teachers as affordances to their learning (26 segments, or 15%, were discussed as inhibitors to learning). Group narratives involving mathematics peers centered around three main themes: Teacher Course Assignments, Instructional and Pedagogical Changes, and Valuing Collaborative Opportunities.

Teacher course assignments. The courses to which teachers were assigned played a central role in determining who was consulted for professional assistance. For this sample, this included instances where teachers were assigned to teach courses in areas in which they hadn’t had coursework for many years (“I always go to Pat or Mel because they’ve already taught the subject; with a higher level subject, other people haven’t taught it….you can go to them, but then…there are things that they just don’t
remember.” (1a:11-15)³; “for things that I’ve done…but not necessarily taught to
somebody” (5a:12), or in areas for which they never had the coursework in college (e.g.,
Statistics).

Teachers often sought help from peers when they were assigned to new courses
and needed to learn what the common expectation was for pacing of the material (how
long to focus on each topic) and the order in which topics or book chapters were taught:
“So I knew the material. I know Algebra 2, I know Geometry. I know it, but I didn't…
know what the scope and sequence was, I didn't know where we were starting, where we
were ending…So I went right to the source. I went to Lee… and she was wonderful. She
had everything saved from the year before” (4a:46). Working with one another in this
way helped teachers to balance department expectations with their own teaching
decisions: “you even said to Sam ‘maybe you’re doing too much on your (curriculum
guide), because Sam was saying that he never gets to cover everything before the
common assessments and of course you brought up the point then you have too much in
your (curriculum guide)...So we can kind of encourage each other with that, …if one
teacher said ‘I’m never getting to it’ ... you guys as a group evaluates is that really the
correct (curriculum pacing), maybe it’s not” (2:7).

The writing of these curriculum pacing guides by teacher teams to align state
standards with textbook resources had historically been times in this department when
teachers were required to work together. But prior to this groups’ involvement with the
³ Citations of teacher conversations indicate interview number and segment number from the transcript.
Teacher references to “you” indicate one teacher addressing another teacher in their interview group, not a
reference to the author. Slash marks in interviews indicate a change in speaker from one teacher to another.
Midwest State project, (which required the involvement of all of the teachers in the
department), either the department chairs did this work for the rest of the group (1a:21;
3:9), or individual teachers created the maps and shared with those who were teaching the
same course (4a:51). Curriculum planning had often been fractured and rushed, and had
resulted in the past in poor communication within the department, leading to different
teachers using different textbooks for the same course (4a:54) and even, at times,
confusion as to what course was actually being taught (“I didn't know there were two
sections. I was teaching out of the green book and I was teaching basic [level]. So I got
what we were supposed to teach and I taught it. Well I wasn't supposed to be teaching
that. I was supposed to be teaching [the level below basic]....So, that was the
communication we used to have in the math department” [4a:61]).

Teachers also spoke of sharing course materials with other teachers which they
had either written themselves (e.g., Powerpoint presentations) or created to supplement
their textbook lesson, but then never having anything shared in return. “It’s a little
…disheartening because you feel like you’re being taken advantage of” (3:54). “I'd wait,
wait, wait, and multiple people never shared back, and I’m like,‘You know what, I’m
going to quit giving you my stuff’” (1:33). These were examples of teachers seeing their
peers as inhibitors to professional learning, and are relevant when viewing teacher/school
groups as networks that may share, distribute, or generate knowledge for its members, or,
in these cases, hinder the flow of information.
Building-level professional development meetings at the school, however, had recently shifted towards requiring teachers to work in small groups, and the Midwest State University project included work that focused teachers in course groups within their department. This resulted in increased communication between teachers, which led to shared expectations by the group and the fostering of trust: “When we first had these meetings, it was all the principals talking. We sat there. I couldn’t tell you one thing that we learned. Then when they started (allowing us to meet as a department)…I was ecstatic. I was sick (one day)...I was gonna go home but I stayed because we actually got to sit together. And talk” (2:51). “We were able to bounce questions off of each other and you know, work together... until we actually are (now) giving it an extended amount of time” (3:24). “The #1 thing that this project has done for us ...has got us to talk to each other” (4a:63).

In a related narrative, teachers appreciated opportunities to learn the expectations for students in courses occurring after their own: “If they’re coming to (certain courses), they need to be challenged…so, I need to really start doing that, and I got that just from us talking and listening to you.” So it’s a good thing that we are meeting and doing those types of things” (1a:35). Similarly, some teachers wished they had more access to one another so that they could share course content expectations more often: “they’re thinking in Algebra I, oh do we really need to know how to factor because we’ll just use

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4 Teacher references to “you” indicate one teacher addressing another teacher in their interview group, not a reference to the author.
the quadratic formula? And I just am screaming, yes, yes we need to know that! (for later mathematics courses)” (1a:47).

Teachers whose assignment was to teach a “singleton course” (a course for which there is only one section, or only one teacher assigned to that course) saw this setting as a disadvantage in that their ability to work with others within the department was limited: “So …the only time I really worked with another teacher (was when) we were teaching the exact same subject” (1a:21). Teachers in these classrooms felt isolated as a result and wished for more opportunities to collaborate: “As far as talking to others, I haven’t done that. And I probably should because I really feel so much like an island” (1a:37).

Teachers assigned to work together as a result of teaching in inclusion classrooms, on the other hand, were able to reap the benefits on a regular basis of having someone with whom to consult professionally. The special education teachers acknowledged their need for help with learning the mathematics content, and that their assignment to an inclusion classroom, and the continual collaboration with a content specialist, had helped them tremendously. “As a special ed teacher, the whole entire math department has been expert to me… I’d have to actually learn the stuff because I didn’t go to school for math. So, we had to relearn from high school what we did in math” (5a:14-15). “There’ve been times when I don’t understand a concept because I’m not a math person and I’ll go to you and say how do you do this? What does this exactly mean? You’d explain things like rational numbers to me and in a way that I understood
better…, (you have) a good way of explaining and breaking things down so I can understand more advanced concepts that I wouldn’t normally get” (2:2).

Similarly, the mathematics teachers in those settings noted how much they’d learned from their special education teaching partners. About the special education teacher, one teacher remarked that “Nicky is always pushing me. She uses it (new technology) most of the time and it works well because we are in there together” (4b:1); while the special education teacher commented, “Yes… Chris ‘here he goes again. Alright, let’s just try it.’ It’s a fun day” (5b:13). Another mathematics teacher related how “working with you (the special education teacher) has really made a difference… I never really thought about it in terms of the students…the common assessments and even my regular tests…now I’m looking at it and it looks sort of overwhelming to (the students), they already have that defeated feeling. And looking at the font, making sure they can read it I think is a big thing. So that’s something I went back and changed” (2:4).

Teachers in these settings also discussed working together through situations that were not always easy or comfortable. “(Some teachers)…can go so quick… can change things… are so smart… but I’m like ‘aah! What?’…I think we’re more nurturing …we’re trying to make (the students) talk” (5b:13). Like the teachers in Interview 2 above, this narrative discussed how mathematics teachers, who majored in mathematics, benefitted from the special education teachers’ expertise of working with multiple levels and types of learners. In another example, teachers discussed how this constant access to one another at times led to opportunities for younger teachers to gain expertise from more
experienced educators. When dealing with parents and administrators, for example, one teacher advised another to “own some of the problems. Say, ‘you know what, I should have done this differently, I did make a mistake.’ … don’t go in there like you’re always right, you know, because you’re not. … and I also said ‘your tone is turning the kids off, you know, you got to watch that’” (2:35). Likewise, teachers offered advice to one another in classroom management as well as passed on critical knowledge of departmental expectations: “(I told the teacher) we need to go over the homework (with students)…knowing the general idea of what needs to be done and the main goal I think is very, very important” (2:40, 45).

**Pedagogical and instructional changes.** Teachers also related stories of asking for help from one another when they were required to implement a new innovation, such as when all of the departments in the high school were required to write common course assessments to be given to all students in the school on the same day of the month. Included in this plan was a requirement that all teachers use the assessments to identify students who needed additional instruction, and then spend the following week differentiating instruction and re-testing the struggling students. Some interpreted the mandate as something positive for the department: “I think the common assessment has helped to bring more focus to the department…we have more discussions now./ Yeah, we have more discussions./ We have more time that we need together…We have a task./ We have something …we gotta get to” (5a: 21). Others recalled when a new textbook with a different pedagogical approach had been chosen by a committee of administrators and

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5 Slash marks in interview transcripts indicate a change in speaker from one teacher to another.
teachers; the change in text materials as well as the instructional approach caused many of the teachers to seek one another out for discussions that allowed them to make sense of the mathematics and the pedagogy: “[I went to Pat] since she already had the background of the sequencing and the pedagogy of what’s supposed to happen in (the course) …(she) helped me with having a brand new book … and with it being a lot more wordiness and not as many examples from when I took the course or studied that” (5a:9).

Another stated that “it’s …not so much that I a lot of times need help with subject matter, but … maybe methodology and even now, what’s really good about what we’re doing now is the opportunity that I’m getting to maybe go somewhere kind of activity-oriented” (1a:17).

Teachers being required to learn and implement new technologies often caused them to seek help from others in their department, especially from younger teachers who were adept at using, for example, Turning Point software, Edusoft software, and the Mobi projection system. Others were influenced by peers through informal sharing and encouragement: “I’m not really good with new technology and…it’s really…it was her encouragement that…allowed me to have the nerve to say, “Okay, I’ll try it” (1:4). Another teacher discussed sharing ideas with a younger teacher: “(if) she's doing more technology, then I better be using more technology too” (2:47). Technology, when discussed in this context of informal sharing between peer mathematics teachers, was seen by the group as an agent for affording teacher learning.

**Valuing collaborative time.** Teachers in the department, over the previous years of increased time working together, had come to see their structured collaborative time as
important and beneficial. In particular, teachers discussed their experiences around teaching a common lesson (the Peer Observation Lesson described in Chapter 3) as allowing valuable time for them to interact and learn from one another. The observations of one another and the follow-up group share-out was an opportunity for teachers to self-reflect and consider how their own instruction might be improved. “The really big thing I got out of (the common lesson) was the differentiation between two classes, the way that lesson was adapted to meet the needs of each set of students... the research lessons are good. I like seeing what other people do. It does help me come up with different ways to do things” (1a:50). All five of the interviews discussed the value in seeing how different teachers interpret and implement the same lesson: “Andi kind of just introduced it and stepped back for about 5 minutes and then interjected. And Lee kinda walked them through a little more than I did, but all three, I was impressed...with their classroom management, their setup of the rooms, I mean it was just great for myself to see that we're all doing sort of the same things with getting to the end the same way” (4b:28).

Another theme common to the narratives about the common lesson was teachers reflecting back on, and ultimately changing, something in their own instruction: “I learned a lot because I didn’t…I sometimes don’t give my kids enough…I’m afraid of giving them too much, so I don’t give them enough support. So then, they’re really struggling too much, maybe to the point where they’ll give up. So, then watching Sam, I thought, you know what? I am going to do a little more review than I had actually planned” (1b:2). Another interview showed teachers reflecting on how much they allowed students to struggle with mathematics: “when I watched Pat’s class, you know,
for me, it was like, okay I do need to take a step back. I do have to put a little bit more in the students’ hands…I think sometimes I struggle with that because it tends to be a lot easier/ yeah, we both do/ To…hold their hand through it./Yeah.Yeah/…Instead of giving them some time to flounder on their own./Yeah, yeah.” (3:42).

Other teachers saw value in the common lesson in that it helped them to feel as though they weren’t struggling with classroom issues alone. “Our focus was not in there to really observe the other teacher. We went in there to observe the students in that teacher's class. That's what we were there for. ..My students struggled with the same thing that his students struggled with...we got to talk after each class” (4b:20, 21). “I got to get out of my classroom and see other teachers in action…to know ‘you’re not the only one that’s struggling”’ (3:43).

Seeing some teachers struggle with a new lesson was, however, “uncomfortable” for some, particularly when students were not prepped correctly for the lesson (e.g., knowing there would be visitors in the classroom) or when teachers disagreed with certain instructional practices (ignoring behavior issues, not calling on certain students, etc). Several narratives also expressed that, although valuable and worthy of repeating, the structure of the day needed to be more flexible. “I think that (lesson) was kind of almost artificial because it …wouldn’t have been our normal progression to go to that, it was something kind of out of the blue and we had to kind of fit it in there, and it felt a little awkward” (2:21). Teachers whose pace was different from those in the course group were also faced with decisions about how to adapt the lesson so that it would still
be effective, even without the pre-requisite lessons leading up to it. Teachers also noted that the situation itself seemed contrived and somewhat artificial: “I think the kids were very well behaved. Like, I know they were in my class more-so than I think they normally would’ve been… In a perfect world, it’d have to be more consistent. /Right./ (so) that you could get a better read and a better feel” (2:46, 47).

So, although the group had experienced large professional development meetings which did not fit their needs, had not in the past shared materials or information very readily with one another, and had some concerns about the way the common lesson was set up, overall, the group comments about their professional interactions with one another and their opportunities to learn from one another were overwhelmingly positive and seen as affordances to their own learning. This node in their social capital network was mentioned the most often as having the biggest impact on their professional growth.

About their required time together as part of the project, in specific, one group commented: “As much as it was a pain at the beginning, …just the more meetings and the more time …and the… /it’s more on your plate, no matter what…/We’ve all really come to realize how important it is and how much help it has become” (3:81).

**Self.** Initial coding of the interviews did not include the category of “self”. It seemed unnecessary and redundant to highlight each individual since the very definition of “social network” includes individuals (actors/nodes) linked together by varying degrees of tie-strengths and communication patterns (connectors). However, as coding progressed, and stories of individual reactions to either other network members or to
events to which the network was required to respond, it seemed important to recognize this category as well. Of the total of 472 minutes coded as discussing actors or nodes, 55.5 of those minutes (12%) were coded as related to the idea of teachers relying mainly on themselves when they needed professional help.

When asked why teachers don’t use one another as resources more often, interviewees described a comfort level with the status quo, or the way things have always been done: “they’ve just been used to, you know, being in their own room and doing their thing/….Right, you figure it out yourself” (1a:28). Teachers described spending a lot of time on their own “if there’s a topic that I just have a really hard time with….researching the internet, looking in other books, making sure, hoping, that I can understand it” (1a:29), where “you basically do your thing on your own…you didn't really have anybody else to go to” (4b:19). At times, special education teachers teaching a new course would be just a few pages ahead of the students, taking the books home and doing the homework assigned to students in the general education classes in order to be able to provide support for their students the next day (5b:25). This continuation of Lortie’s “culture of isolation” (Lortie, 1975) was due to an attitude of “some of the older teachers (in the building who) just (say) ‘well, this is what’s worked for me in the past and I’m just going to close the door and …I’m going to do what I need to do’” (5a:38). “There’s I think a certain level of comfort there that they haven’t reached yet. They’ve just been used to, you know, being in their own room and doing their thing./ Right, you figure it out yourself./ A lot of people are afraid to ask. They don’t want to look incompetent” (1:28,29).
There was also an element of pride (4a:52) or ego (3:26) involved, and a “mentality that what teachers have in their classroom they want to keep secret for some reason. …What I do in my room is my business and how I teach is my business, and I don’t want to take it outside of my room. I don’t know, am I wrong?/ …I think to an extent, yes. …I think it’s gotten a little better” (5a:25). In the past 2 years, they noted, things had begun to shift: “…it’s a pretty new thing. It’s sorta funny because …until all this, I would never really have even thought about it…you kind of grow up thinking like your teaching is…you’re really kind of isolated from others” (1a:32). Teachers were reflective of their own attitudes towards the change of a more collaborative culture, stating that it was only recently that it had begun to emerge into something that they wanted or needed: “Up until two years ago it didn't happen here.... I will tell you this - if I had to teach (a former course), I probably wouldn't have sought out the other teachers…Because, whether it was right or wrong …I've been teaching it, I'm comfortable with it” (4b:36,37).

Some of what was shared in these interviews and coded as “self” can be construed as teachers simply doing their jobs of reading, sense-making and lesson planning, which is ultimately something teachers must do individually in order to adapt according to their own teaching styles and to the group of students with which they will be working. But these passages also revealed a pattern of “going it alone” for most of their career (including making decisions about what text to use [3:8]), with a recent trend towards seeing the value in sharing their knowledge and expertise outside of their classrooms.
This category was not coded according to “inhibitor” or “affordance” as the characteristics of the teacher comments did not fit into those descriptors.

**Administrators.** After the category of “Peer Teacher”, interviewees spent the most amount of time discussing issues coded as “Administrators”. Of the total of 472 minutes coded as discussing actors or nodes, 96.7 of those minutes (20%) were coded as teachers discussing administrators in relation to their professional growth. Of the 58 instances (or narrative fragments) that were coded as discussing administrators, only 9 (16%) of these discussions referred to administrators as affordances in their learning. Much more prevalent were narratives of administration as inhibitors of teacher professional growth (49 segments, or 84%). Three dominant themes emerged from these conversations: constant change, teacher marginalization, and ignoring of teacher expertise.

**Constant change.** Discussions amongst teacher pairs often centered around their efforts to adapt to the many changes they faced in their classrooms, the majority of them a result of administrator mandates. The district experienced a very high attrition rate for its administrators in the years prior to and during the study, having hired 4 superintendents, 4 high school principals, and 5 curriculum directors within the 10 years prior to the study. With each administrative change came new ideas on how to improve the district, which meant new mandates for the high school mathematics teachers. Every teacher group interviewed expressed frustration, and at times, exhaustion, in their attempts at meeting these new demands. “This is my 15th year, and we’ve probably gone
through about 8 different changes...we’ve been trained, and trained, and trained” (5a:26);
“it’s just the constant change...as soon as you get comfortable with something, then it’s
time to change again. I just never feel settled. I’m always unsettled. I’m always feeling
like I’m trying to find something new, do something new” (3:11); “We have reinvented
the wheel in this district in my 20 years 7 times I bet/...that’s basically what we've been
doing I think all the time/...(we) just keep putting band-aids on it...I don't think we've
had a superintendent for longer than 4 years since I've been here” (4a:1, 7).

The changes which the teachers discussed included many decisions which
impacted their teaching lives directly and forcefully: eliminating a mentorship program
which paired teachers with students for academic counseling (1b:39; 5b:2), changing the
middle school mathematics curriculum (3:13; 5a:26), creating new school policies (e.g.,
dress codes, book bags, discipline policies, etc) and not enforcing them (1b:28; 1b:24;
5b:35), choosing mathematics textbooks, requiring teachers to write common
assessments, requiring teachers to incorporate technology into their lessons (e.g., clicker
technology) as well as requiring teachers to learn and use new technology in order to
input scores from their common assessments. One teacher interview pair expressed their
frustration with the software interface they were required to use for the common
assessments because the objectives in the software, which had to be aligned to their
assessment questions, were not matched to the current state standards but to the software
publisher’s own set of teaching objectives (3:10).

Inconsistencies and rapid-fire changes from the administrators (both district-level
and building-level) left teachers feeling exhausted and anxious: “I just never feel like I’m
ever… my head’s never above water. I’m always treading” (3:17). This frustration in turn left teachers feeling drained of the energy needed to analyze or adapt their instruction, which ironically, was the purpose of the administrative edicts: “You never have time …to become confident in (using) those (new) resources. …you’re constantly trying to…to figure out a new way to come up with teaching this and coming up with something fun that’s going to grab them… I’m always struggling…to keep up on it” (3:17). “We’re all so…focused on our curriculum, on getting through the day, on getting through common assessments, on getting through standards that, I don’t know/…So focused on, I gotta get through this. I gotta get through this /… I’m so far behind/….I’m not even where I’m supposed to be, and I gotta make my kids take that common assessment” (5a:36). Multiple demands and stresses on teachers’ time did not allow teachers the space needed to reflect and plan, either individually or with one another. Many teachers, “overwhelmed” and defeated, adopted the attitude of “I’m going to do what I need to do, and… if you wait long enough, it’s going to go away, right? / …here’s the new thing, but…/Right, eventually it’s going to work its way back around and it’s going to be the same old thing (as) in the past, so…” (5a:28).

*Teacher marginalization.* Throughout the changes experienced by these teachers, they also consistently expressed dismay that large-scale decisions were made without their input, that their expertise and experiences were constantly ignored in decision-making contexts, and that they were rarely given any choice in how or whether
to participate in the change efforts presented to them: “none of us made these rules, but …we’re told to enforce them, and they make no sense to me” (1:30). Some administrators had asked for teacher input in the past, but current and past decisions had not left teachers with any feeling that they were supported: “There’s been surveys and I think it’s just to kind of make us feel (better)…. I think they would pick and choose the survey. If they got the results they wanted…then they’d make the change. But if they didn’t get what they wanted, there was no change/… The current administration doesn’t even give us surveys/…At least in the previous ones, they kind of at least gave us a survey and they pretended that we had some input. But the current one just basically passes out their orders” (1:29-30). Teachers were rarely asked for their input: “Not once was I ever asked any opinion I have about (a student intervention program with which he had had experience). Never once. And not to this day” (4b:48). When teachers attempted to offer suggestions based on their professional judgment and past experiences, they routinely felt marginalized and not heard: “they ask but they’re not listening” (4a:44).

Teachers felt that there was a pattern of administrators coming in new to the building (or district) and dismantling any programs that were associated with the outgoing leadership: “when (the principal) came in and you say he said he had to do a lot of cleaning house. The house wasn’t that dirty. I mean, it really wasn’t. He, you know, just wanted to like completely empty it, and then fill it with his own things, which is what he did….But he got rid of a lot of nice furniture” (1b:33). “We had (the International Baccalaureate courses) going on. IB was…’whoa, nope. Now we’re bringing (in) AP (instead)’…Anything (the former principal) initiated had to go. We had a mentorship
program and/...oh my gosh, the mentorship program was wonderful” (1b:39). When asked if the administrators knew about some specific knowledge of a certain teacher, the response was, “Oh they know of course. Yes. But it doesn't tie in/... if it's somebody else's idea, it doesn't get done” (4b:49).

In one narrative, teachers described how administrators had decided to create a student intervention to prepare students for state tests. This 3-month program (begun in January) pulled at-risk students out of their mathematics classrooms, causing them to miss mathematics instruction, for remediation and re-teaching of mathematics concepts prominent on the state graduation exit exam. In addition, several periods a day of this intervention were to be taught by mathematics teachers, thus pulling those teachers from instruction for the remainder of their students (who were also under pressure to perform well on the state test). Mathematics teachers presented reasons to the administration as to why this was not sound educational practice and expressed concern for the students who would, as a result, be missing out on crucial instructional time. The pullout plan was implemented anyway. “What was most frustrating about …the pullout (decision)… (is) that we'd been working for a year and a half together (as a teacher group) and we are now strong. We are a group, and it got shot down. And I haven't spoken to (the principal), probably won't be for a while, but it's just …it's status quo. What has been going on for years, for years” (4b:15). In another part of the same interview, the teachers discussed the incident with similar intensity: “if I became a principal tomorrow and I had to make a decision about the science department, I can't ever imagine that I would just make a decision …I would get my science teachers together and (ask)... what are we doin’ here?
what's best? what are we doing? should we do this? should we do that? no? yes? then that's what we're doin’... when our (department’s) members of the (building leadership team) said that we don't think that it's proper (the pullout intervention program)... we're wasting time, many different reasons why... it got shot down immediately... and that's just not right” (4a:24). In another interview, a teacher asked, “Is anyone going to listen to us?” (5a:29).

One of the few statements made by teachers which were coded as “affordances” coming from administrators concerned an assistant principal who had initiated a multi-year professional development initiative in the building which, among other things, sought to establish teacher professional learning communities, create norms for staff communication, and sharing of teacher expertise throughout the building. This administrator had left the district between Years One and Two of the Midwest State project, but was remembered fondly as one who “gave you choices… (and would say) ‘we want you to try this, but (would let you) kind of do it in your own way’” (5b-7). Other teachers recalled being released from their classrooms by administrators in the past for time to work together and share resources and ideas (1a:21; 3:22), and felt that that time together supported them as learners.

**Ignoring teacher expertise.** Teachers felt not only as though their expertise wasn’t appreciated, but often that administrators belittled and de-valued their professional knowledge. The principal, and to some extent, the superintendent, were repeatedly described in terms of “micromanaging” and “belittling”: “we’ll probably get snapped at
because/...Right/...That usually (happens)/...on a regular basis/...we are belittled at times where we can’t make a decision on our own when, even though it’s better...it’s for the mass. So, that can be very frustrating...(they) really should be listening to what (teacher leaders) have to say/...(our administrators) micromanage everything” (3:64-67). Teachers consistently spoke of either not being asked for input, or in some cases, intentionally disrespected: “I’ve heard the quote out of (the principal’s) mouth. ‘Why do people have to think for themselves? Why can’t they just follow these directions? Why do they insist on thinking for themselves?’ That is a direct quote” (1b:30). The concerns extended to the superintendent: “it’s also obvious how our new superintendent treats us as well” (1b:31). Language used by their new superintendent in public forums to discuss serious educational issues, teachers felt, was threatening and unprofessional: “If I hear one more time that they [students] are two years behind when they get here, I’m going to vomit”6. Teachers felt as though his words were an attack on them and the work they were trying to accomplish with their students.

Additionally, teachers were worried and felt caught in the middle as they heard about power struggles between the new and longer-term administrators: “we’re worried about ...the rumor that (the principal) is going to be done...(if) we get a new person in, are they going to be on the same boat or are they going to fight for us as much as she has (with the new superintendent) or...you know, is what we’re doing even going to be the path (of the new administration) or...is there going to be the ultimatum and say, well this is what we’re going to do or...?” (5a:29). So, although the group felt that their current

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6 Citation withheld to protect anonymity of participants.
principal had made poor decisions and marginalized teachers and their expertise, some felt that he at least “fought for them.” When faced with a new administrator, more senior in position, who used even more threatening and degrading language towards teachers than their principal, the group felt powerless and at the whim of administrative factions, neither of which was seeking or citing teacher experience or expertise in their decision-making.

Given teachers’ interactions with most of their administrators, the stresses they felt from a constant stream of new reform initiatives, and their lack of input into many of the decisions made which impacted their classroom lives, it is not surprising that 84% of their narratives were coded as “inhibitors” of social capital. However, negative case analysis of the transcripts with a focus on what teacher narratives didn’t say (Richert, 2002) did reveal additional interpretations of their cultural stories. While most teachers expressed frustration at the numerous initiatives being thrust on them, there were some who pointed out how certain programs had actually caused them to cohere more tightly as a learning group. The requirement of writing common assessments was mentioned as one example of this in that it “helped to bring more focus to the department…We have more time that we need together... We’re more on the (same page) with a task/….yeah…we have…something we gotta get to” (5a:21). So, although the teachers felt inundated with additional meetings and deadlines, having a focused task helped them to spend more structured and productive time together as a group. Similar claims can be made for when teachers had to figure out how to implement new curricula, new courses, and new intervention programs. In each case, teachers recounted stories of sharing resources with
one another, or seeking out others in the department in order to ask for professional help in some form. Therefore, there were cases where some teachers experienced a change initiative as negative or uncomfortable, but when viewed through the lens of social capital, could be reframed as affordances to teacher learning.

One interview gives a hint at another theme which was noted as one not talked about by teachers, that of being provided the support they need to be able to make the initiatives successful: “all the constant, I mean, we were … in the process of doing the data, but it’s not…it just seems like…we have all these initiatives, all these things that we’re supposed to be doing, but then there’s never any follow-up with it…we’re just constantly, you know, you do this, do this, do this, do this, do this, do this, but there’s never any support ” (3:21). Although teachers had many ideas about how they could improve conditions in their school, what was not discussed were the structures and resources that administrators should be providing in order to allow teachers to implement new programs aimed at increasing student success. Teachers were comfortable, as already noted, discussing, and at times offering to administrators, solutions to issues around student discipline and student learning (e.g., the narratives about teacher protests against the math pullout program or teacher suggestions about how to improve student behavior), but did not discuss similar solutions for issues around their own learning or their own access to social capital.

**Peer teachers (non-mathematics) within the building.** Teachers within the mathematics department included their non-mathematics peers in the building as
resources for professional help, although to a much smaller degree than administrators and their mathematics peers. Of the total of 472 minutes coded as discussing actors or nodes, 47.3 of those minutes (10%) were coded as teachers discussing peer teachers (non-math) in relation to their professional growth. Of the 21 instances (or narrative fragments) that were coded as discussing peer teachers, 17 (81%) of these discussions referred to their peers as affordances in their learning, while 4 segments, or 19%, were mentioned as inhibitors.

Teacher narratives which discussed the influence of their non-math peers often focused on their need for assistance in learning new technology. Several interviews named technology as an area in which they’d needed help in the past, and that they looked to others within the building for this support. The computer support person for the computer lab had been asked by several teachers for help, but as one with a non-teaching background, that person had been unable to provide assistance with helping teachers to adapt and create lessons around a particular technology or piece of software (1a:44). These comments may have been referring to the software which teachers needed to learn in order use immediate-response “clickers” in their classrooms (there had been a directive that all teachers had to incorporate them into at least one lesson), or to the software which was necessary for them to record the results of their common assessments. At times, other teachers in the building helped them (5a:42), or they went to the Internet to find lessons and technical support (1a:18). Technology concerns were also prominent for this group with regard to learning how to better utilize calculators with their students, and in learning how to use GeoSketchpad software with Smart Boards.
Their building peers were also mentioned as affordances to teacher learning by the special education teachers in the department. They appreciated, and took advantage often of, the knowledge that their fellow teachers shared, “someone that was …truly our peer. She …walks in the same door we do and has the same kids we do. So, she’s trying it, so I can try it, too… (the differentiation tool she created) was a better example to us than a video” (5b:6). Working with the same students and in the same environment as they did gave credence to the strategies these teachers shared, and it encouraged them to inspect and make changes to their own teaching: “There’s wonderful teachers here with a wealth of knowledge …you’re like, well, if they’re doing it, maybe I can do it/…I think we have gotten a little braver about trying different things that we normally wouldn’t do” (5b: 3-5). One mathematics teacher, however, did not feel that the whole-building sharing sessions were as applicable to her work – they needed to be more content-specific (e.g., concept maps which were appropriate and useful for humanities courses are not always so for mathematics, etc) (5a:23).

Additional examples included peer mentor relationships teachers had when they first started teaching, and learning the basics of teaching, such as classroom discipline, record-keeping, pacing of material, and how to relate to the students in their classrooms (3:2). In general, teachers saw their peer teachers as affordances to their learning rather than inhibitors, especially in the area of special education. Technology resources were seen as needing to be more available to them, and thus the peer teachers in the building connected to technology were coded as inhibitors to teacher learning.
External actors/nodes. Teacher discussions of whom they consider to be contributors to their professional growth also cited resources external to both their department and the school. These resources included teachers in other schools, university professors (including those involved in the MSU project), and other providers of professional development. Of the total of 472 minutes coded as discussing actors or nodes, 36.3 of those minutes (8%) were coded as teachers discussing external resources as related to their professional growth. Of the 40 instances (or narrative fragments) that were coded as discussing external resources, 30 (75%) of these discussions referred to these resources as affordances in their learning, while 10 segments, or 25%, were mentioned as inhibitors.

Perhaps due to my involvement as a Research Assistant in the MSU project, or possibly due to the fact that the research questions of this interview asked explicitly about teacher reactions to some of the MSU project activities (e.g., the Peer Observation Lesson), the majority of the narratives around external resources mentioned MSU’s work with them over the time frame preceding the interviews. Teachers discussed how “up until last year when we started the project, I mean even in our math dept meetings... everybody was just kinda their own teachers. They were... you teach Algebra, you teach Geometry and you teach this... and we didn't do much collaboration together. It's tough to get organized” (4b:13). So, although teachers had been meeting via building initiatives, they did not feel as though it was true collaboration. The project and its resources gave teachers “that time to sit together and you prompted questions that made us actually discuss it. I don’t think we did it on purpose. I just don’t’ think we ever
had… that time to be together/…The opportunity to do it, or we didn’t have a common goal (together)” (5a:20). Other teachers in the building took notice, and asked the mathematics teachers how they felt about the work they were being required to do with the project: “I tell them..the biggest thing is that it's brought us together as a department, not only as our little subgroups…the number one thing that this project has done for us ...(it) s got us to talk to each another” (4b:14, 15, 63).

Teachers also felt that the department’s involvement with Midwest State brought a level of credibility to the work that helped them with their interactions with building administrators. One story involved teachers in the department seeing a need, and subsequently drawing up a proposal, for a new course. What in the past had met strong resistance from administration was this time approved quickly. Teachers said that they had told the administrators that “Midwest State is going to help us with it and this is what it's for ...(they answered) ‘That’s wonderful. That sounds wonderful.’ (We said)...’okay phew,, got that through’” (1b:42). Although some teachers noted that the work did add more to their day, especially in the form of increased time in meetings (“it’s just one meeting after another…It’s almost like we’re having meetings to meet’ [3:21]), one of the benefits of their work with a university was that “the math department (here) has less flack and control from the administrators for some reason. I think they think we have it together because we’ve been working together for a long time on our curriculum and all of that” (1b:29).
Additional benefits of the partnership for some also included being able to draw on the credibility of a university to influence their students: “they want (math) spoon-fed to them, but we keep saying,…’MSU says you need to think, so I’m giving you a thinking question’…it works…even if we’re like, putting it on you guys” (5b:10). One teacher recalled how students reacted to the presence of one of the professors as a guest teacher in her room: “I’m like, this is Dr. C. ‘What do you mean Dr.?’ They don’t understand the Dr. part. …I said, this is a real professor. A real professor from Midwest State. So, even that has been...A lesson for them… for them, for a real, bona-fide professor to come in has been very (special)/…It’s what you see on TV” (5b:11).

Work with Midwest State also included support for teachers from university mathematicians during the planning phase of their Peer Observation Lesson: “(the mathematician) came in and explained that lesson perfectly. And when he left, boy it made sense to me. Now I understood it. I didn’t understand before he came in, so that resource was great…it was a great lesson” (4b:30). Every teacher group said that they felt as though the project work had been worthwhile and had benefitted them professionally: “We’ve all really come to realize how important it is and how much help it has become” (3:81).

Additional references to external resources included comments about college courses, college professors, training teachers had attended (e.g., how to use smart boards or graphing calculators), professional development for teaching Advanced Placement courses, and professional conferences. The narratives which were coded as inhibitors to
teacher learning were instances where teachers felt that training they received either was not followed up (“We had two waiver days across the district… we were gonna institute Baldridge Training, and then it just went away after a year” [4a:3]), or did not match their classroom needs (resources were aligned to old standards, etc). On the survey question which asked teachers to describe the vision of the math department, one wrote: “We value our time and do not appreciate wasting it in workshops not geared to our professional advancement” (1D1A).

**Identification of Connecting Elements in Teacher Social Networks**

Social capital is defined not only by the nodes or actors which interact, but also by the interactions themselves, including the conditions which afford or constrain the sharing of resources between actors. Using theoretical models of social capital (Adler & Kwon, 2002; Coburn & Russell, 2008), as described in Chapter 3, narratives were initially coded to detect teacher stances towards the four main elements in those models which connected the social network actors to one another:

<table>
<thead>
<tr>
<th>Connector</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Motivation/Trust</td>
<td>Degree to which teachers trust those in the social professional network; closeness of teachers to others in the network</td>
</tr>
<tr>
<td>Opportunity/Structure</td>
<td>Opportunity for teachers to collaborate, talk, discuss, have professional conversations</td>
</tr>
<tr>
<td>Ability/Access to Expertise</td>
<td>Knowledge contained by those in the network; level of mathematics content knowledge; knowledge of teaching (general) and how to interact effectively with students</td>
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<td>-----------------------------</td>
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<tr>
<td>Depth/Pat�ns of Interaction</td>
<td>Extent to which conversations involved low-depth vs. high-depth issues surrounding teaching (low depth – pacing, scope and sequence; high depth = student thinking around tasks and how instruction can address student misconceptions, etc)</td>
</tr>
</tbody>
</table>

As coding proceeded, it was noted that teachers discussed issues of trust of one another (peer teachers within their department) separately and in a different way than they discussed trust issues around administrators, so this category was further delineated using those labels. Analysis also pointed to the need for a fifth category, which I labeled “Group Self-Knowledge,” and which is highlighted in gray in Table 13. The patterns and themes which emerged from the narrative analysis as descriptive of each “connector” category are summarized in Table 13:
Table 13: *Themes from Teacher Narratives Mapped to Theoretical Model Constructs*

<table>
<thead>
<tr>
<th><strong>Connector</strong></th>
<th><strong>Themes from Teacher Narratives</strong></th>
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<tbody>
<tr>
<td>Motivation/Trust</td>
<td>Peer Teachers:</td>
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<td></td>
<td>- Trust of each other</td>
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<tr>
<td></td>
<td>- Beliefs about student learning</td>
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<td>- Beliefs about mathematics</td>
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<td>Administrators:</td>
<td></td>
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<tr>
<td></td>
<td>- Trust of administrators</td>
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<td></td>
<td>- Power and governance structures</td>
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<td></td>
<td>- Building culture and attitudes towards teacher expertise</td>
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<tr>
<td>Opportunity/Structure</td>
<td>Proximity</td>
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<td></td>
<td>Building Schedule</td>
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<td></td>
<td>Courses they teach</td>
</tr>
<tr>
<td>Ability/Access to Expertise</td>
<td>Content/Pedagogical knowledge of the teachers in the network</td>
</tr>
<tr>
<td></td>
<td>Teacher knowledge of who has what expertise</td>
</tr>
<tr>
<td>Patterns of Interaction</td>
<td>What teachers discussed; what knowledge was shared</td>
</tr>
<tr>
<td></td>
<td>What teachers didn’t discuss</td>
</tr>
<tr>
<td>Group Self-Knowledge (new</td>
<td>Beliefs about their own learning</td>
</tr>
<tr>
<td>category)</td>
<td>Identifying what resources they have, what they don’t have, and what they need</td>
</tr>
</tbody>
</table>
Total minutes discussed in the five interviews for each category are represented in Table 14 below:

**Table 14: Total number of minutes for each connector category discussed in interviews**

<table>
<thead>
<tr>
<th>Connector Category</th>
<th>Number of Minutes Discussed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust - Peer Math Teachers</td>
<td>194</td>
</tr>
<tr>
<td>Trust – Administrators</td>
<td>108</td>
</tr>
<tr>
<td>Opportunity/Structure</td>
<td>89</td>
</tr>
<tr>
<td>Access to Expertise</td>
<td>130</td>
</tr>
<tr>
<td>Patterns of Interaction</td>
<td>38</td>
</tr>
<tr>
<td>Group Self-Knowledge</td>
<td>72</td>
</tr>
</tbody>
</table>

This same data is visualized in Figure 9 below using a circle graph in which each connector category is represented by a circle whose diameter is proportional to the number of minutes spent discussing the category.
Figure 9: Number of Minutes Spent Discussing Social Network Connectors (or WHAT afforded or constrained their professional interactions)

In Figure 10 below, the data is further delineated by interview, with each circle’s diameter representing the number of minutes spent in each interview discussing teacher interpretations of the connectors of their social network.
Figure 10: Number of Minutes Spent Discussing Social Network Connectors by Interview

Elaboration on each of the categories coded as “connectors” follows.

**Trust – peer teachers.** Trust amongst their math department peers mattered to these teachers when they were seeking out professional support or advice. This category represented the greatest amount of time (194 minutes out of a total 631 minutes, or 31%) which teachers discussed as an aspect of their interaction with other actors in their network.

Teacher narratives described a teaching culture which, in the past, had isolated teachers from one another with a “mentality that what teachers have in their classroom they want to keep secret for some reason” (5a:25), and where “egos” (3:26), “pride”
(4a:52), and not “want(ing) to look incompetent” (1a:29) held them back from either sharing their expertise or asking for help from others. Teachers, however, spoke of being helped by other teachers with whom they were friends (4a:32), of being able to get to know other teachers better when there was a common lunch period (4b:19), and how inclusion teaching settings had helped to increase trust between partner teachers (5a:25, 2:2-4). The Peer Observation Lesson, likewise, served as a vehicle to allow teachers access to each others’ instruction and the decisions they made before, during, and after lessons.

The extended opportunity which the mathematics department had to collaborate, first through structured initiatives from within the district (2:51), and then through the Midwest State project, had given teachers a sense that things were shifting away from teachers as isolated individuals and more towards a culture where it was acceptable to try something different instructionally: “I’m getting more comfortable being able to (teach an inquiry lesson) as opposed to just going right down through a list of notes and a step-by-step procedure and being able to kinda let the kids guide their own study kind of thing. Having that, kind of trust and confidence …the way that…we’re going to get somewhere without me having to be scared…the whole time” (1:17). Where one teacher had written on the pre-survey that “the department contains a few teachers who just ‘do their own thing’” (2F1A), several teachers on the post-survey noted that “members of the math department have a much better line of communication than before the MSU projects” (2F1B) and that “we communicate fairly well with each other now that Midwest State has become involved” (2F2B).
The need for “trust amongst your coworkers” (5b:31) extended to their interactions with administrators. Some spoke of teacher leaders as those who should “never ask …teachers to do something that (they) would not be willing to do first (themselves)” (3:56), being able to depend on them to follow through, and ultimately as a “way of speaking to the administration without actually going (to them themselves)…like a security blanket” (3:63).

An interesting pattern emerged from coding and comparing the interview transcripts and analyzing the teachers’ pre- and post-survey responses. Although teachers spoke of the importance of trusting one another and their improved levels of communication as a department, they were more reluctant to speak directly about differing beliefs within the department. On the written open-ended survey, on which teachers did not identify themselves, several comments stood out:

- I do not think we teach consistently the topics in all math classes, i.e. Algebra I – not all topics are covered with the same value placed on them (2H3A);
- The department is not cohesive. Some like discovery learning, hands-on projects; others like lecture and notes, practice and drill (3NA);
- I feel we all agree the state has set the requirements at an unreasonable level for “ALL” students (3D2A).

These comments, all written in the pre-survey, were indicators that there were divisions within the group along lines of beliefs about what mathematics is important to teach, how
best to teach those topics, and their beliefs about students’ capability of achieving at higher levels. Given that this portion of the survey was administered before the two-year MSU project (but after a year of the district’s professional development initiative), it is not surprising that there were differences in these areas. After 2 years and over 200 hours of professional development, however, post-survey results indicated that the divide might still have been present:

- Sometimes I feel our department is split between those who want really high expectations for our students and those who believe our students can’t do it (3SB);

- Unfortunately, many teachers don’t believe our students are capable of higher learning (3NB);

- I think our department has a hard time believing that the students are capable of the common core standards. (3RB).

When transcripts were analyzed for these themes involving beliefs about mathematics and learning, including examining what teachers did not address, narratives revealed a tension between meeting students’ emotional needs and “getting through” challenging mathematics. One teacher shared that a veteran teacher had mentored her with this advice: “Mal did help me in that one. He says you just…you can’t have that emotional connect. You know, …this is what you have to finish through the curriculum or you’ll be stuck on one topic for the whole year” (3:3). Others elaborated on their struggles and their thinking as they managed these day-to-day instructional decisions:
We went from grouping by skills now to differentiated instruction and I think it's much more difficult to have student-centered learning - if you could keep it to grouping by skills in your classrooms and know who and how and what, you can... analyze your students and it would make it a lot easier (4a: 33);

So there’s a difference, too, with her style compared to, I think, some of the other teachers because he really does take the time to try to make sure the kids understand it/...I want to give (the common assessment) to them when I’m ready (3:29-30);

We’ve already covered the materials. So, I spent a whole class time...reinforcing what they’ve already done, so where (other teachers) probably are moving on, I’m not. I’m making sure they have this and they get to get out of the classroom. They get to get on a computer. They get to, you know, work with different programs, that kind of stuff, where again, it’s not a wasted class time, but it’s a day of less instruction because it’s/...it’s just practicing./ It’s for them just to be able to go over and feel a little more confident/...Seeing it in/...seeing it in a different way... I’m in the lab once a week. So, I know right off the bat, if I go to the lab 7 times, that’s 7 days that I’m behind them right off the bat, right off the top. But I’m not willing to give that up yet, either (3:34);

One of the strengths that I’ve seen in certain teachers, certain teachers are really, really good at relating to students, and really getting students to trust them, which,
that is more than half the battle if you want them to really think mathematically or
do more work … than they really want. … build that relationship (5b:16).

- Now we’re doing these problems that are a lot harder … all these application
problems … I’m trying to do that more on my tests, too … not a straight forward
task like it used to be. You know, it’s a lot more … thinking … I made a quiz
…and I put all application problems, except for a couple, all application where
they had to actually read and figure out what was being asked, and … I made them
do the challenging problems. And any more, it’s like … it’s so … I want to say
watered down. Especially with the new book that we have, it’s so watered down.
It’s not challenging to me at all, and so … I thought, well … they need to be
challenged (1:35).

Teacher accounts such as these reveal how different teacher groups dealt with the
numerous pressures they faced, including intense pressure to improve state test scores,
elimination of lower track classes, and exposure (through new curriculum and the MSU
project) to pedagogical methods that encouraged student inquiry. Additionally, teaching
mathematics at the high school was made more challenging because of changes (in
content, pedagogy, and curriculum) at the middle school level over which the high school
teachers had no control and implemented by middle school teachers with whom they had
no dialogue. Without support managing these multiple changes, or a unified vision from
administrators that could direct their decision-making, teachers turned to those they
trusted when they needed professional help. This was very often teachers who held
similar beliefs about what mathematics should be emphasized (e.g., skills or applications) and what instructional practices to follow (e.g., how much time to spend on which topics, how to balance caring about students with challenging them mathematically, etc) (2:48; 5a:31; 1:24; 4a:35; 3:58-61).

At times, it was the students who noticed the differences in teaching styles. Student comments to other teachers resulted in uncomfortable moments between teachers: “sometimes I get the curiosity of what are you doing that we’re not doing in our own classroom...the kids come to us with a lot of extra/… Problems…./I know that it’s about teaching math, but at the same time, if you don’t show an interest in the kid and you don’t make those connections (with them)...” (3:58-61). This below-the-surface tension within the department, around which trust relationships manifested themselves, was clarified by this teacher group’s perspective: “(for our students), you have to break down so much more. You can’t assume when they come to class that they are prepared...the catch-22 question is...do you move on or leave kids behind?” (3:4). How teachers would answer this question often described their peer trust relationships – they sought out others in the department who had the same beliefs about teaching and about mathematics as they themselves had.

Trust – administrators. In the previous section discussing administrators as nodes in teachers’ social capital network, teacher narratives noted that administrators play a critical role in high school teachers’ interactions with and efforts to access professional assistance. Teachers in this study described an environment where they perceived
administrators mainly as inhibitors to their professional growth, with the one exception being an assistant principal whom they felt understood their challenges as teachers and knew how to provide them the support they needed. “Trust” of administrators then logically emerged from coding teacher narratives for evidence of how they connected to one another and how they accessed the resources they needed. Teachers discussed this aspect of their social capital for a total of 108 minutes, or 17% of the total time during which their narratives addressed connectors within the network.

Trust of administrators was influenced by how teachers experienced the rapid turnover in administrative positions and the resultant fallout from multiple short-lived change initiatives: “If you wait long enough, it’s going to go away, right? Like…here’s the new thing, but…eventually it’s going to work its way back around and it’s going to be the same old thing in the past, so” (5a:28). Teachers spoke of initiatives that were often hastily introduced and rarely with any follow-through: “We’re given that data and expected to come up with interventions so quickly that I don’t think they’re really effective. I really don’t. Basically what happens is you just re-teach the same stuff and we’re not really doing it a different way (2:8); “We have reinvented the wheel in this district (so many) times/…that's basically what we've been doing I think all the time/…we just keep putting band-aids on it…I don't think we've had a superintendent for longer than 4 years since I've been here” (4a:1-7). “This is my XXth year, and we’ve probably gone through about 8 different changes of what the new word of the day (is)…and this, that, and the other” (5a; 26).
Throughout these changes, as noted in an earlier section, teachers felt marginalized and that their professional input, based on experience and expertise, was not valued. “(with the) old regime, again reinventing the wheel... they ask (us) but they're not listening” (4a:40,44). Decisions made by administrators often required teachers to implement a “process (that) …wasn’t connected to what you were doing in your classroom” (5a:23), had no input from teachers, and were based at times on what the teachers perceived to be random or irrational reasoning. When deciding who would get donated technology, for example, one teacher shared, “this is gonna sound like it's a joke...(but) first come, first served (is how they decided who) received the Smart Boards” (4a: 67). Governance practices in the district and building often felt to teachers like “getting on everybody’s bandwagon” (5a:29) or “the flavor of the month or year…” (5a:38).

When teachers raised objections or concerns, they “got reamed for saying it” (1b:34) or were “snapped at because./Right./ That usually happens./ on a regular basis…we are belittled at times where we can’t make a decision on our own” (3:64-65). A culture that devalued teacher expertise and also marginalized teachers’ ideas with regard to building governance resulted in a lack of trust of administrators in the district, so much so that they felt that often they only had each other: “I do think that …we see so much change in leadership that we’re the only constant. And we just gotta get on it, keep getting on everybody’s bandwagon, and they’re going to change the world, but….is anyone going to listen to us?” (5a:29-30).
Opportunity/structure. In references to social capital’s “structure”, Adler & Kwon (2002) characterized this dimension of their model as “the resources that (actors) could potentially mobilize via their social relations” (p. 27). Coburn & Russell (2008), interpreting “structure” from the organizational model as “ability” in their educational model, operationalized that construct using measures of tie strength and tie span (or length) between nodes in teacher networks. In this current study, teachers’ ability to access professional expertise in one another, as well as in others inside and outside of their building, was often discussed in terms of how close teachers’ rooms were to others’ in their social capital network, and with reference to their daily teaching schedule. Teachers discussed this characteristic of their social capital for a total of 89 minutes, or 14% of the total time during which their narratives addressed connectors within the network.

Often cited as a factor in whom teachers ask for professional help was their proximity to one another in the building based on their room assignments. “It’s who you’re teaching next to, of course……I’ll talk to Chris across the hall…/It’s easier to talk to Chris when she’s right across the hall. I mean, I’m sure Lee has lots of good ideas…But he’s on (another) floor…” (2:48,50). In some cases, room location was a more important factor than which department the teacher belonged to: “when you’re next door to a teacher, that’s your sounding board….we don’t teach the same subject anymore, but…it’s just…it’s what you do. You sound off about the same issues all the time... even though Lou is only (a few) rooms down, it’s difficult to walk down there and have a conversation with her. So it is nice to have people that you respect and like around you
because it really does help” (3:5). The building was designed to have all of 11th and 12th grade teachers on one floor, all 10th grade teachers on a separate floor, and all freshman teachers on another separate floor: “it is your neighbor that you go to…well, that is how we’re arranged” (1a:23), by grade levels rather than by departments. This was seen by some as a disadvantage, in cases where, for example, teachers had said they needed help learning how to use a graphing calculator, and there was no one in a room close by who could help them (1a:24). Others wished they could more easily access one another: “he’s got great skills with working with kids…it would be great to have him closer” (5b:27).

Teacher narratives in this study also commonly attributed a lack of professional collaborative time together during their school day as a reason why more teachers did not seek one another out for professional support. At West High, a common planning period at the beginning of the day, allocated for the purpose of encouraging professional time for meeting and sharing, limited their ability to utilize one another more often: “Because of the schedule, (we) are always teaching at exactly the same time during the day...It's a huge building….The only time (we could ask for help) is the morning...” (4b:40). This time in the schedule, however, was also teacher’s preparation time for their instructional planning. With only 42 minutes per day in which to follow up from previous classes (grade assignments, record and figure grades, analyze results, answer emails, respond to parents, etc) and to plan for upcoming instruction (create interventions, gather materials, plan instruction), this time was not conducive for use as built-in professional development time: “if I had a real concern … I would go and ask someone. But I don’t
want to impose and take all of their prep time” (1a:27). For teachers who had other
duties during that time (building meetings, teaching at-risk students who were scheduled
for extra intervention during the day), their access to one another was severely limited
due to the schedule. When discussing teachers’ restricted access to one another, some
said that their loss of a common lunch period was one reason why this situation had not
improved (4b:26). Others noted that “there's a lot of teachers in this building who don't
even know each other. I mean you walk down the hall and say good morning to each
other and (they) don't know (one another)...” (4b:21).

During times when teachers did meet, narratives noted that there was a need for
structure and organization to those discussions: “that time has to be used wisely,
otherwise teachers get turned off real quick” (5:3). Teachers talked about the difficulty
of balancing a need for structure with a flexibility which would allow teachers to be
creative professionally:

So, everyone is together in a lab or in a room or whatever, and you
work together, but you’re structuring it, but (with) some flexibility for
teachers to work with each other, to go and ask other people, but
you’re still maybe in one general area….In other words, it’s required.
Required. You gotta make it required./ …But what’s required is
more flexible./ …I mean, I’ll be honest, I don’t know if I would do it
if it wasn’t required. But if they said to me, ‘Look, this is what
you’re to do with that hour and a half once a week’ or whatever, I
would do it. I would be there, and I’d say, ‘Okay, this is my time that I’m going to meet with these teachers and that’s what we’re going to do’… you need someone who’s going to make you accountable” (1b:21, 23).

This idea was repeated throughout many of the interviews, with the related question of “who’s gonna lead it? You know the department heads are the department heads, but is it their job to get people organized?…(In other meetings we’ve had), there just wasn't any real direction” (4b:13). So the dimension of “structure” to these teachers was interpreted as proximity, time during their professional schedule to meet together, and having expectations and structure for that meeting time.

Access to expertise. In current social capital models, access to expertise is defined in terms of “ability” (or the resources teachers could potentially assemble through their social contacts) and includes the knowledge contained within the system (Adler & Kwon, 2001; Coburn & Russell, 2008). Teachers at West High discussed this topic in their narrative (sometimes in response to direct questions by the researcher) for a total of 130 minutes, or 21% of the total time in which they discussed connectors within their social capital network.

The response of teachers to the question “who has what expertise in your department?” was initially to say that this was not knowledge that they possessed. “I still think there’s that mentality that what teachers have in their classroom they want to keep secret for some reason …I don’t know why. What I do in my room is my business and
how I teach is my business, and I don’t want to take it outside of my room/….I think it’s
gotten a little better” (5a:25). Teachers were hesitant to offer any opinions about the
expertise of others, partly because of their isolation from one another professionally: “we
all kind of live in our little world because we all teach (during the same
periods)...nobody's in anybody else's classroom. ... We don't know./ Yeah. We just don't
know” (4a:10), or because of more unspoken agreements between teachers that this
subject is not discussed: “as far as knowledge mathematically or educationally, I couldn't
judge anybody at this point” (4b:3).

Some did admit to having knowledge of when teachers were struggling with
student discipline, and this was because of word spreading throughout the building: “if it
was the other end question... ‘who would you not go to, who is the biggest problem,...
who would you eliminate as a teacher’... that comes mostly from teacher gossip. There
aren't many teachers walking around saying ‘Hey! Joe over there... he's a heckuva guy
with Turning Point! He does amazing things with it!’ No. You say, ‘Joe, his kids are
climbing out the windows all day long’” (4b:11). Others shared what they knew
about other teachers’ expertise in dealing with students: “Char is good at breaking it down so
(others) can understand it. Or they’re not as inclined or patient. He is very patient and
willing to work with somebody who doesn’t get it - and a lot of math teachers talk ‘up
here’” (gesturing upward) (2:3). Some discussed their own strengths in relation to their
beliefs about student learning: “(some kids will) open up about stuff that they don’t
always tell (other) teachers because they feel a little bit more confident with us….When
they get to some of the other classes, …they kinda get stopped in their tracks because
some of the other math teachers might not be as approachable with some of that stuff. And I know that it’s about teaching math, but at the same time, if you don’t show an interest in the kid and you don’t make those connections…” (3:61).

When it came to knowing if anyone had more expertise with mathematics, most claimed that “there isn't anybody that's up here and anybody that's down here” (4b:3). Department members felt that “all of our math teachers are teaching what they’re supposed to teach...They’re hard, hard workers...personality-wise, some of us do that better than others (dealing with students)” (5b:40, 45). They believed that teachers were placed into their courses correctly, as far as their knowledge of the mathematics, and that “what they’re experts in would depend on what they’re used to doing….I think we’re very…diverse and so…it just depends on what you consider expert knowledge. If it’s just the actual content, I don’t really think we have a problem with that...” (2:14-15). Most teachers did not believe that they needed any help themselves with understanding mathematical content (5a:12; 1:17), including those who admitted to not being very strong mathematics students themselves. Special education teachers did admit to not being as strong as mathematics, and feeling comfortable asking for, and receiving, help from either their partner teachers or from others in the department. And their mathematics peers told of changing their approaches to assessment, technology and intervention based on observing and consulting with their special education partner teachers. Some teachers discussed feeling more comfortable and more qualified (“more effective”) teaching lower level classes, or vice versa, based on their perceptions of their own expertise.
When teachers did broach the subject of others whom they felt were lacking expertise, it was in the area of student relationships, and it was mentioned only briefly: “I think we do kind of place people correctly for the most part. The ones that…maybe in our department struggle with kids, no matter what area you put them in, they’re going to still struggle with kids…I sometimes think they’re oblivious to it” (3:39). Some felt comfortable naming teachers who were very organized, or who were strong with technology, but the strongest message from all of the groups was that “we’re just peers to each other...who are we to say that …my way is working better for the kids versus someone else?” (3:36); “As far as knowledge mathematically or educationally, I couldn't judge anybody at this point” (4b:3).

Teacher comments about their Peer Observation Lesson were interesting to analyze in light of “access to expertise”. This experience was structured to allow teachers time to prepare a lesson together, discuss how to observe one another in others’ classrooms, and then debrief with one another once the lesson was complete. Although explicitly designed for teachers to focus on student classroom behaviors and student mathematical thinking, the common lesson nevertheless caused teachers to reflect on the expertise of others and themselves. “It was very eye-opening. It lets you just see, you know, because everybody teaches different…Everybody does teach different. Everybody has their own way” (5b:38). Some teachers expressed feeling supported or validated by seeing lessons that were strong (with good classroom management, classrooms set up well, etc.), where teachers “used different approaches” (4b:21): “the really big thing I got out of it was the differentiation between two classes, the way that lesson was adapted
to meet the needs of each set of students” (1b:40). Some stories involved teacher observers feeling uncomfortable in class with how some teachers interacted with students, some having seen teachers ignore groups of students altogether, and others observing teachers “grilling” students in classrooms that felt “tense” and “awkward”. Comments during the interviews were tentative when discussing these incidents, with some offering the explanation that “personality-wise, some of us do that better than others” (5b:45), describing how some teachers are better at connecting to students outside of the classroom rather than during formal classroom time. These comments were rare, and when they did occur, were brief, and often preceded by a disclaimer such as “I don’t want to call anybody out…”, or “everyone is working hard and teaching what they’re supposed to be teaching.”

Patterns of interaction. The extent to which teacher communication reflected district vision and goals, as well as the depth of teacher discussions, has been found to be an important, additional dimension of social capital models in previous studies (Coburn & Russell, 2008). This study was not focused specifically on this dimension, and thus did not explicitly measure, either quantitatively or through qualitative interview data, teachers’ depth of interaction. However, their narrative stories did reveal some interesting patterns with regard to what they typically discussed, and/or for what topics they sought professional help from their social capital network. Keeping in mind that this study did not seek to measure this dimension, coding sought patterns in teachers’ “background” stories, contrasts in what teachers discussed versus what they did not discuss, or subjects teachers indicated that they felt uncomfortable discussing in any
depth. This category was coded for 38.3 minutes (6%) of the total minutes in which teachers addressed “connectors.”

As previously noted, teachers talked about how their communication had changed over the course of the past few years. As a department, in the past, they “were left on our own. We’d have some small conversations, but we weren’t forced to do it….So, we did kind of keep to ourselves a lot” (3:21). However, through reforms initiated by building administrators, and through activities agreed to involving the Midwest State project, they had begun to collaborate more often and, in their opinion, more effectively: “I definitely think we work as a group better and we bounce ideas off (each other) more (than) in the past. I think we’ve actually talked about it and I think we’re teaching similar lessons now, at least, I think we share more” (5b:19). There was general agreement on the value of collaborating with peers, particularly within the department and with regards to issues specific to their teaching of mathematics. However, teacher narratives most often centered around such topics as timing and pacing of their teaching, coverage of standards in preparation for state testing, student discipline issues, students’ lack of foundational knowledge (called “skills” by some teachers), and parent and administration issues.

Although teachers did mention that they were working well with others in their course groups to write common assessments, their work in this area was focused on completing an online template of topics and typing up common assessments. This was more of an exercise to fulfill an administrative mandate, rather than a tool which they believed they needed and could thus use to identify struggling students, and results could be used to make instructional decisions.
Teachers often discussed issues about students which impacted their classrooms: discipline, the school dress code (or lack of one), school rules for students, students’ lack of initiative to learn, students’ challenges at home, and students’ lack of foundational mathematics knowledge. Offshoots of these conversations included some mention of the need for parental support, and the need to know more about what the middle school math teachers covered and what pedagogical approaches they were using. So, although there were some discussions amongst teachers that would be categorized as “medium” level using Coburn & Russell’s scale for “depth of interaction” (e.g., how students perceived assessments – the wording, spacing, size of font, etc [1a:40; 2:4]), most narratives detected in these interviews centered around issues that had immediate impact on their professional lives: how to interact personally with students, how to maintain classroom order, and how to manage their students in the face of some school rules which they perceived as ineffective, and others which they perceived as missing and sorely needed. Teachers, though not always in agreement, were becoming more accustomed to discussing together how to pace lessons, which textbook to use, how to prepare students for state tests, and how to implement new courses and choose textbooks to support those courses. Due to building and district reform initiatives, teachers had also gained experience in working together to meet administrative mandates requiring use of new technology, writing and scoring of common assessments, and then creating and implementing interventions for students based on the assessments.

These initiatives, along with some introduced by the Midwest State project, did result in some teacher discussions about new instructional approaches, including having
students work in small groups, requiring students to create visual organizers for their work, and posing “rich” problems that required greater cognitive demand. However, references to these types of interactions were fleeting or nonexistent, depending on the group being interviewed. There was no evidence in the group narratives that their “typical” discussions involved how to get students to engage with mathematics at a deeper level, or student misconceptions about mathematics, or that they needed to be encouraged and supported as they looked for solutions to problems that they identified together. Teachers also indicated that they did not feel comfortable discussing the levels of expertise in other teachers in the department (e.g., who had strong mathematics content knowledge, or who needed support in how they dealt with students). These areas were either unknown to the teachers in the department, or were topics that were dismissed or not discussed. Teacher dialogue, as described in these group narratives, was most often centered around topic coverage, meeting the demands of state tests, and meeting district and building mandates.

**Group self-knowledge.** As coding proceeded, and as outlined in the previous sections, there were definite parallels between what the West High School teachers were sharing in interviews and the dimensions of the social capital theoretical models which guided my study. Teachers’ narratives clearly detailed reliance on certain actors or nodes, which could be coded accordingly, and then fell into the models’ existing categories for “connectors” or those elements which impacted teacher groups’ abilities to access professional help. Consistently, however, certain comments were set aside in coding and not seen as fitting in any of the existing categories. Through the constant
comparative method of qualitative analysis (Glaser and Strauss, 1967/2007), and repeatedly revisiting the literature base, I determined that this group of narratives and comments constituted a new category. Prompted by teacher reflections, as well as my findings from negative case analysis (or examining transcripts for what teachers were not saying), I labeled this dimension “Group Self-Knowledge”.

Whereas previously coded teacher comments focused on trust (of each other and of administrators), building policies (schedules, room locations), the amount of expertise in the group, and the focus of teachers’ conversations with one another, this set of narratives addressed the group’s ability to take stock of and monitor its own resources. This department, in the process of creating a new learning culture together, was also creating new vocabularies with which to interact and with which to analyze their own practice. This was new ground for them: “I never really thought … ‘Oh, I should be preparing my lessons with another teacher or discussing my lessons.’ I mean, I just never even…that never even crossed my mind to do that….The only thing you might go to another teacher about is a problem with a student” (1a:30).

When asked to identify what they needed in order to be successful as teachers, or for their own professional growth, teachers’ first responses typically involved technology (“I wish they'd give us workshops on a continuing sequential basis …To me, every geometry teacher should have a Smart Board” [4b:64, 66]), or more time to get their work done, either individually (“reflection time”) or collaboratively. One teacher shared, “it's not so much resources. We have the resources. We have the technology. It’s just you never have time to play. You never have time to play to become confident in those
resources” (3:16). In this context, teachers did not discuss the lack of guidance or vision from administrators, or the lack of a clear purpose for the large amount of time they were devoting to reform initiatives introduced by their building principal. They did not mention a need for a structure to support their work together as a network of existing knowledge and experience, e.g., the requirement of time, training, and reinforcement for teacher leaders who agree to shoulder some of the responsibility for implementation.

When asked to identify who has what expertise in their department, teachers stated that they didn’t know, or were hesitant to discuss the topic. Teachers within the department were viewed as equally competent and as dealing with equally challenging situations and students: “the biggest thing I pulled out of …that common lesson…(was that) my students struggled with the same thing that his students struggled with and what her students struggled with. We didn't go to any classroom and say.. ‘oh my goodness.. they're whiz kids. What am I doing wrong?’ Or we didn’t go to anybody's classroom and say ‘these kids are a bunch of rocks’” (4b:20). The group felt that their mathematical and pedagogical knowledge was solid: “all of our math teachers are teaching what they’re supposed to teach” (5b:39); “I knew going in that they were gonna do a great job…I was impressed …it was just great for myself to see that we're all doing sort of the same things with getting to the end the same way, and it's good to know that any of these guys are doing a great job like I thought they were” (4b:28).

The same held true of discussions about teacher competency with mathematics. Either it was understood that everyone had the knowledge, or there was hesitancy in
calling anyone out on those issues: “who would I consider to have great knowledge in the dept as far as knowledge ...math knowledge? I wouldn't really know because besides last year's common lesson ...I mean all of us... we know the subject, you know. There isn't anybody that's up here and anybody that's down here. But as far as knowledge mathematically or educationally, I couldn't judge anybody at this point” (4b:3,4).

There were some statements made about teachers’ ability to relate to students, some referring to themselves (“one of the assets that I know both of us are good at is we do very well with learning our kids and learning how to push their buttons” [3:44]), and others referring to their peers (“[we do discuss] who would you eliminate as a teacher... and that comes mostly from teacher gossip” [4b:10, 11]). In this case, group culture allowed for discussion of teachers who could and could not relate to and/or control students: “sometimes the supposed experts are too focused…It’s not that they are not very knowledgeable, but not everybody can teach” (5b:31). Some talked of teachers who “built relationships” with students outside of the classroom, but were not able to do the same inside the classroom. Teachers knew this was a sensitive subject, didn’t want to “call others out”, even when they’d witnessed lessons that were tense and awkward, and in which students were, in their opinion, treated poorly. When asked who had what expertise in the department, one group responded: “(we know) if it was the other …question... who would you not go to, who is the biggest problem... There aren't many teachers walking around saying ‘Hey! Joe over there... he's a heckuva guy with Turning Point...he does amazing things with it!’ No. You say “Joe, his kids are climbing out the
windows all day long.'/You hear the latter, that's what you hear./ Yes. you never... Very seldom do you hear the other. At least I don't” (4b:11).

Teacher narratives could identify other teachers who needed help in their relations with students, even as they admitted that the teachers themselves most likely could or would not be able to do the same: “I think sometimes the ones that need the help, they don’t see that they need the help… The ones that, you know, maybe in our department that struggle with kids no matter what area you put them in, they’re going to still struggle with kids...I sometimes think they’re oblivious to it” (3:40, 41). In these stories, individual self-awareness was lacking in those teachers whom the group felt were lacking in a certain area of expertise, and there were no group norms or structures in place which would have allowed intervention or even more public recognition that the issue existed.

Some teachers did identify in interviews areas which they themselves felt they needed professional help. It was “in bounds” to admit a weakness in using new technology, when a new course was assigned for instruction, or when new curriculum approaches were introduced and expected to be implemented (e.g., using more inquiry-based approaches, or having students work in small groups). Yet, even in these cases, teacher beliefs differed as to the emphasis needed for reinforcing skills versus having students spend longer periods of time on rich problems, or on the ability of their students to be able to succeed in mathematics at any level. On the pre-survey, a teacher shared her belief that “the department is not cohesive. Some like discovery learning, hands-on projects; others like lecture and notes, practice and drill” (3NA), and then wrote on the
post-survey that “unfortunately, many teachers don’t believe our students are capable of higher learning” (3NB). These sentiments, which were not shared in small group interviews, revealed areas where department members had potentially conflicting beliefs about student learning and mathematics, and included topics about which the group had unspoken norms that disallowed identifying or discussing the rifts.

Without a language to describe and discuss group strengths and weaknesses, teachers and administrators were unable to define, describe or address the groups’ overall level of expertise. When asked, teachers in the group recognized the potential: “it would be ridiculous not to use each other because we are (knowledgeable)...it’s just a shame” (5b:37); “they came up with solutions with their particular group...(they shared) what was going to work for them, but maybe we could come up with something….we’ve got a galore of problems” (5a:45); “so much can be done here at this school because there are some expert teachers here... you’re like, well, if they’re doing it, maybe I can do it” (5b:3,4); “I would just to like have other people like tell me ... ‘that was good or that really wasn’t’” (1a:47). Poignantly, and possibly as an explanation, these comments occurred within a school climate that did not include teachers as decision-makers and in which the teachers felt that their expertise was continually devalued. One teacher asked wistfully, “is anyone going to listen to us?” (5b:29) while another recalled hearing and administrator ask ““Why do people have to think for themselves? Why can’t they just follow these directions? Why do they insist on thinking for themselves?” That is a direct quote” (1b:30). In the face of these types of challenges from administrators, a group culture that had vehicles for identifying and assessing its own existing resources would
also be able to clearly define what additional resources (external to the building, or from other teachers in the building) would be needed in order for a reform initiative to be successfully implemented. The dimension of “group self-knowledge” describes a category of social capital attributes that are crucial to the identification and sustainability of teacher and school social capital resources.

**Social Capital within the West High Mathematics Department Network**

Phase II of data analysis in this study used techniques from narrative analysis (identifying narrative arcs in the stories teachers told) and categorized common themes using critical event analysis (Webster & Mertova, 2007) in order to identify the stories which held the most meaning for the teachers in this network. The narrative themes were compared to existing models of social capital and this groups’ social capital was found to include the other teachers in their department as central actors or nodes, then administrators, peer teachers in the building (non-mathematics teachers) and external resources. Their stories addressed directly the connectors in their social capital network of motivation/trust and opportunity/structure. They discussed much less often the dimension of “ability” within their network, and did not address directly the notion of depth of their professional interactions. Discrepant case analysis also revealed the need for an additional dimension, that of “group self-knowledge.”
CHAPTER V

DISCUSSION

West High’s Story –Math Teacher Narratives Interpreted

Through a Social Capital Lens

This study set out to examine the construct of social capital as experienced and interpreted through narratives constructed by a high school mathematics department. Their story, of urban high school teachers who manage classrooms and students from high-poverty backgrounds, has been told many times before (e.g., Jensen, 2009; Resnick & Glennan, 2002). This story, however, is different in that it used narratives interpreted through a social capital framework and examined how high school teachers defined and interacted with the elements of social capital which they perceived as present (or not) in their school environment. The section begins with a discussion of the dominant narratives which the teachers defined, and is followed by, and contrasted, with the topics which teachers did not discuss. Identified through negative case analysis, the data revealed an element of social capital not present in current social capital models that would have significantly benefitted this group. Through the re-telling of two representative vignettes, the case is made for including an additional dimension to existing social capital models, that of “Group Self-Knowledge”.

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Teacher Talk and Awareness of Social Capital Dimensions – Structure and Trust

When prompted with interview questions aimed at detecting teacher interpretations of social capital, teachers most often addressed the two social capital dimensions of “Opportunity/Structure” (or ties to others in their network) and “Motivation/Trust” (trust of those in the within the network). These were the areas where teachers told the most consistent stories, and where story frames and themes overlapped and repeated themselves. The responses coded as Opportunity/Structure revealed clearly their definitions of whom they included in their professional network, to whom they felt connected, and whom they sought out for help. These nodes” in their network included peer teachers, administrators, peer teachers in the building, and external contacts (professors, teachers in other districts, etc). This category of “Opportunity/Structure” assumed a relationship existed between the asker and the giver of advice, one in which expertise was identified in the teacher who was asked for advice, and was also identified by the requestor as knowledge or a resource that was needed. These responses were instrumental in identifying the main nodes of the social network, or the members of their network which they identified as important to their professional growth.

As teachers discussed the elements in their system which they felt afforded or inhibited their professional growth, they talked about their physical proximity to one another in the building, the building schedule, and the courses they teach as elements in their school environment that impacted their ability to seek and obtain professional help. Closely related to these themes were teacher concerns involving technology, pacing
guides or other curriculum-related issues (textbooks, etc), and time during the school day. These “first wave” topics, as I came to call them, were those which were “safe’ to discuss, particularly when it was early in the interview and boundaries and trust were still being negotiated, however silently or below the surface. There was a high level of agreement within the group about these issues, and teachers felt very comfortable discussing their concerns and recommendations about these resources with one another. These influences on teacher access to expertise are, interestingly, closely related to Spillane & Thompson’s (1997) definition of physical capital, or those financial, material resources which are able to be bought and sold.

Measured by some as “tie strength” between teachers, or how often teachers consulted one another in an established group and whether those requests were reciprocated (Coburn & Russell, 2008), the notion of a tightly connected network is one that West High teachers recognized as well. Their work together in small, course-specific groups for planning, teaching and evaluating a common lesson, e.g., revealed that they felt more supported, more connected, and generally had greater access to the ideas and knowledge of others in their department as a result of this collaboration. This finding aligns with the ever-accumulating body of work on the importance of teacher learning communities (DuFour et al., 2004; Henderson & Gornik, 2007; Louis, Marks, & Kruse, 1996; McLaughlin & Talbert, 2006; Niesz, 2010a; Wood, 2007), and the connection between higher levels of teacher collective responsibility for student learning and strong professional communities (Louis, Marks & Kruse, 1996).
Teachers talked the most often, however, about the connector “Trust” in their social network. This dimension, labeled “Motivation” in the Adler/Kwon model (2002), heavily influenced teachers’ reliance on one another as resources. Trust amongst peers (both general education and special education teachers within their department) enabled teachers to turn to one another the most often for help with their instruction, and their narratives overwhelmingly characterized peers as the greatest affordances for their learning. Collaboration as a department, although initially seen as “a pain in the beginning…more on your plate, no matter what” (3:81), was mentioned by most teacher pairs as very positive, something that had helped them as teachers, and something that they would like to continue (albeit with help, e.g., with an administrator who expects all to participate, yet allows teacher groups the freedom to decide on the focus and depth of their collaboration). They had built higher levels of trust, and ultimately felt that they could help each other more readily than someone who was outside of their department – peer teachers, administrators, or other external sources. Comments about the Peer Observation Lesson was further evidence of this department’s reliance on one another. Hesitant when they first observing one another and discussing the peer lessons, their reactions were ultimately very positive, with teachers expressing that they felt as if they had learned from the process, and that they would like to continue the common lessons in the future.

These results are not trivial. As past research on high school communities has indicated, the departmental structure of high schools provides not only a pre-formed network, but also is the central organizer of their professional identities (Grossman, et
Where some have criticized this structure as leading to a culture that is conservative and concerned only with their own micro-political issues (Little, 2002), the narratives shared by these teachers indicated that the professional bonds formed around their similar challenges of teaching mathematics allowed them access to knowledgeable others for the help and assistance they needed. They were much less likely to seek out administrators, other teachers in their building or external expertise when they faced an instructional obstacle.

This finding is also significant in that this aspect of teachers’ lives, defining their access to resources in a way that includes social networks, sheds light on how ideas spread between teachers, how teachers are able to share expertise with one another (or how they are blocked from this), and the ways in which these ideas are deemed by the group to be important or not important (Weinbaum, Cole, Weiss, & Supovitz, 2008). Teacher beliefs about students (McLaughlin & Talbert, 1996) and about what constitutes “important” mathematics (Rousseau, 2004) play a role here in determining the group expertise that is valued and distributed or passed between members. In high schools, there is the added dimension of how teachers communicate within individual departments, with research showing that departments serve as “micro-communities” within which teachers determine and communicate to one another such specific beliefs as what is acceptable to teach, grading systems, student tracking systems and how they view their students (McLaughlin & Talbert, 1996). These departmental communities are so tightly connected that practices in high schools often vary from group to group, overriding at times school and district policies (McLaughlin & Talbert, 1996). Intra-
departmental dialogue patterns that mediate group thinking towards more convergent problem solving cultures such as those in some mathematics departments (as opposed to the divergent thinking expected in humanities departments) also help determine group boundaries and definitions of teacher practice (Little, 2003). In other words, high school mathematics teachers bring with them their own views on mathematics, pedagogy and professional development, and their patterns of interaction are heavily influenced by these dispositions.

In this study, there was also a strong narrative thread in which teachers identified administrators as the greatest inhibitors to their learning, and issues of trust were the main dimension of social capital that was cited as the reason why. Governance and decision-making practices in the building that marginalized teacher knowledge, adversely impacted their ability to communicate with one another, and disallowed teacher expertise in determining how reform would be implemented were all components of this groups’ identity as revealed through their stories. The one instance of an administrator who did not fit this description was instructive and significant in that teachers described him as one who allowed them to make choices and offered them professional support after listening, or how some would explicitly define “trust.”

Teachers also described the impact of administrative mandates on their ability to form cohesive learning groups – the lack of time afforded them to collaborate, the constant changes in the programs they were required to implement, and the lack of collaboration with district and building leadership as to teacher recommendations on how
or what to implement in order to improve student achievement. Administrators, through their control over structural components of social capital, shape the structure of teacher networks, especially impacting teacher tie strength and the depth of teacher interaction around expected reform initiatives (Stein & Kim, 2008). At West High, decisions about how to allocate resources for classrooms, professional resources to assist teachers in implementing new instructional techniques, and social capital resources (e.g., structured time for teachers to meet and administrative expectations around that professional time) underscored the power of their administration to control teacher access to important professional resources was a common theme in teacher narratives.

These teacher narratives around trust and structural ties revealed a high level of internal agreement about those aspects of their social capital. It is this type of internal consistency within departments that makes reform challenging within high schools (Hargreaves & MacMillan, 1992; Siskin & Little, 1995) and creates unique opportunities for the administrators and educational leaders who wish to bring about change. If what is expected under these reforms is transformative change (Hargreaves & Fullan, 2012) and a shift to a culture of ongoing teacher inquiry (Hoban, 2002), then school leaders would benefit from being aware of the tension these demands on teacher learning create in well-established routines of teacher interaction at the high school level, the embodiment of what Louis, Marks & Kruse (1996) described as “dramatic readjustments in the nature of community” (p.784). High school departments, with an emphasis on specialization (emulating the university model) and cultural routines of interaction around what they value as important mathematics and pedagogy, can find themselves in disagreement with
broader school- or district-wide goals (Louis, Marks & Kruse, 1996). Due to assimilation and teacher relationships formed around subject area concerns, high school teachers in some studies were more likely to forward their own departmental goals and allow them to take precedence over school- or system-wide goals (Little, 2002). The group in this study was disgruntled with many of the initiatives which they were mandated to fulfill, including writing common assessments, grading them, pull-out intervention programs for state-wide testing, and a school-wide effort to get students to increase their writing in all subject areas. Teachers at West High told a common story of frustration over mandates that they felt were out of touch not only with the lives of their students but also with the demands of teaching mathematics.

It is instructive to examine this dynamic in terms of the social capital elements of internal ties (strength of ties between individuals within the department) and external links (to those outside of the department). Woolcock (1998) found that groups with both low internal and low external connections had a low level of social capital overall, while conversely, those with strong links to both internal and external resources held the greatest promise and had the greatest stock of social capital. But interestingly, groups with only strong external links were found to be those who disrupted the local community’s mission or vision, weakening and undermining group norms. By contrast, groups with only high internal ties or linkages were found to also fragment the larger community by maintaining a mission that was myopic and not connected to that of the larger community surrounding it. Table 15 (cited in Adler & Kwon, 2002; adapted from Woolcock, 1998) diagrams the relationship between these constructs:
Table 15: *Relationship Between Internal Ties and External Links in a Network*

<table>
<thead>
<tr>
<th>Low Internal Ties</th>
<th>Low External Links</th>
<th>High External Links</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Low stock of social capital - Low number of external links, low tie strength</td>
<td>2. Contact with outsiders, undermines community solidarity, weakens group norms</td>
<td></td>
</tr>
<tr>
<td>High Internal Ties</td>
<td>3. High internal solidarity – detrimental to actors’ integration into broader whole. May lead to isolation of individuals, fragmentation of the whole</td>
<td>4. Great promise – High number of external links, strong internal ties</td>
</tr>
</tbody>
</table>

For high school departments, greater access to resources, needed especially in times of implementation of change initiatives in the form of support or additional knowledge (human capital or “Ability” in social capital models), is the result of increased social capital that is a combination of strong internal and external links. For high school mathematics teachers, this can be a challenge in that they need external sources which are not only knowledgeable about mathematics but also understand and can communicate with those teachers in the necessarily highly specialized language of mathematics (Horn, 2005). Without access to the mathematics coaches often used in K-8 settings to increase the level of mathematical and pedagogical knowledge amongst teachers (Coburn & Russell, 2008) and with the assumption that they themselves as high school teachers are the content specialists, the role played by district administrators in interpreting, implementing and enacting educational reform is intensified, as is the role administration
plays in setting the stage for the content and depth of interactions between teachers. For example, the Coburn & Russell study (2008) found that, although elementary coaches were accepted by the teachers with whom they worked, administrative decisions influenced, and at times inhibited, the frequency and degree of closeness with which coaches could interact with teachers. How principals allocated coaching and meeting resources and the language used by district leaders to influence how teachers interpreted curriculum resources were examples of this administrative influence.

At West High, administrative expectations were central to teachers’ interactions with one another, often at the expense of their own identified need to learn something new (in an area of content, pedagogy or technology), or in spite of it (at times when teachers sought help on their own or fell back on known instructional strategies). Coburn & Russell (2008) found that distinct patterns of interaction between district administrators were passed on to building administrators, which were then enacted by teachers in their collaborative groups. So, where there was a more open governance structure in the central office, that characteristic was found in buildings and classrooms as well. In a related study, Moolenaar et al’s (2010) social capital analysis found that where principals were more closely connected to their teachers, the more willing teachers were to take risks and invest in the change initiatives being presented, and the more their school culture could be characterized as “transformative”. In other words, the more principals were sought for professional and personal advice and the more closely connected they were to their teachers, the more willing teachers were to invest in the creation of new knowledge and practices. These findings lead to the question as to
whether the communication and problem solving approaches used by the adults in a system are then subsequently transferred to teacher/student interactions at the classroom level.

In terms of the trust narratives told by the West High teachers, their strong internal agreement over what afforded or inhibited their growth could have been a sign that they had a lower overall level of social capital, particularly since their external ties were strained (those with administrators). In the face of many outside stressors, including high administrative turnover, increased standardized accountability, low student test scores, and multiple disconnected instructional reforms, teachers at West High continued to seek solutions, both together and individually. Acknowledging the importance of the support of their peers, the group expressed a need for more time and a school structure (a schedule, proximity in the building, expectations for group behavior) that would allow valuable collaborative learning time to continue. As they engaged in the work required to write the mandated common assessments, create a new mandated course, or write mandated unit objectives, teachers sought support from one another, from their assistant principal and from the professors involved in the MSU project in their attempts to interpret and then enact what they believed was the vision of their leadership and of the organization as a whole.

Administrators, on the other hand, missed an opportunity to take advantage of the group’s cohesiveness. When the members of a school community share a common vision and culture, teachers are more likely to access informally the expertise in one another
(Frank, Zhao, & Borman, 2004). Thus, rather than investing in traditional models of diffusion of innovations through individual persuasion from the top-down, school leaders there could have created structural supports that would have nurtured and sustained the building of teacher ties both internally and externally. Knowledge by school leaders that individual capacity is increased through social interaction (Supovitz & Weinbaum, 2008) and that implementation of any reform by teachers is interpreted and buffeted as group members interact with local contexts could have led to affordances by administrators that would have increased the department’s social capital resources. Instead, teacher decisions at West High about instruction and reform implementation were often filtered through the teacher realities of available time during the day, decision-making and prioritizing of what to teach based on their own knowledge, the expectations of teachers in courses taught later in the high school sequence, and their knowledge of the state high-stakes tests and measures for their building “report cards”. Teacher narratives indicated that they interpreted district goals as aimed at higher test results rather than at an increase in teacher expertise, their ability to increase student mathematical understanding, or increased opportunities for student success in more rigorous mathematics courses (the goals of the MSU project and of the district initiative). Reform initiatives that don’t take into account the modifications needed to alter teacher ways of relating to one another (Horn & Little, 2010) and communicating together (Stein et al., 2008) risk having the effort fail due resistance on the part of the teachers simply because their network ties (internally) or links to external sources which could help them through difficult times (which are to be expected in any transition) are weak (Talbert & McLaughlin, 1996) and
not established enough to support the teachers as they launch into new territory: “the networks in schools are more than just contextual factors of implementation; they are the very means by which ideas spread in schools” (Supovitz & Weinbaum, p. 165).

**Missing Pieces – What Teachers Didn’t Say about Social Capital**

Examining teacher narratives using negative case analysis revealed interesting patterns about the elements of social capital which teachers did not discuss. Narratives involving structural ties (“who”) and trust (“why”) emerged quickly and described a department that was in agreement over these components of social capital. The other two dimensions, “ability” and “depth of interaction”, were not discussed as frequently, if at all. In the Adler & Kwon (2001) model, the category of “ability” included the knowledge held by each of its component nodes, or what others (Burt, 2001; Spillane & Thompson, 1997) have called “human capital” and what Coburn & Russell (2008) labeled “access to expertise”. Coburn & Russell’s (2008) study of middle school mathematics teacher networks also defined an additional dimension, called “content of interaction”, which examined the extent to which teachers’ communication with one another was congruent with district reform goals as well as the “depth” of those teacher discussions.

The “ability/access to expertise” category was operationalized by Coburn & Russell as the access to and interaction middle school teachers had with mathematics coaches in their respective districts. At West High School, where there were no content area instructional coaches, teachers discussed “access to expertise” most often in terms of
their mathematics peers’ expertise. This study confirmed earlier studies (Siskin & Little, 1995; McLaughlin & Talbert, 2001) that have identified high school teachers’ highest level of access to expertise to be one other. For the West High teachers, they were well aware of the need for support in their content knowledge when they were assigned a new course, or when they needed to learn about technology, or a new pedagogical approach. They were less aware of, or unwilling to talk about, the level of expertise of others within the department. Without formalized content area coaches for this high school, they turned to one another, often based on elements related to physical capital - location in the building of their classrooms, or who had been assigned to teach the course. There was more unease answering questions that broached the topic of human capital (such as “why did you go to Teacher X rather than Teacher Y”?), particularly when responses began to involve the level of teacher content knowledge in the group. The first responses were typically “her room was close to mine” (physical capital) or “they’ve taught the course before – I knew they had the knowledge” (human capital). There was a reluctance to answer the question of who knows more mathematics in the department – most teachers expressed that “everyone in the department knows their math.” So discussions around that form of human capital in many ways to this group was out of bounds as far as being able to define a common narrative beyond “we all know our mathematics”. This attitude of the department echoes the teacher behavior which Lortie (1975) called “consistently egalitarian” (p. 102) in which teachers were found to expect and enjoy the authority they could claim over their students, but did not expect extrinsic rewards based on anything other than seniority or their level of education. The finding here is especially
interesting given that teachers were paired in high-trust dyads, so could have easily shared any concerns they held regarding the amount of human capital in their network. There was a sense of not wanting, or being able, to identify who could help them (or not help them) when it came to learning new mathematics content, that this not only wasn’t their job, but also that it was culturally unacceptable to have the conversation at all. Lave & Wenger (2002) described the process of enculturation of newcomers into a system as a matter of “transparency”, in which the practices of the profession are able to be detected, analyzed and understood by group members within a community focused on practice. At West High, transparency of teaching practices, particularly with regard to the level of ability in their system, was difficult to detect.

Likewise, the content of their professional conversations was not discussed by teachers in these interviews. Though not specifically examined in this study, Coburn & Russell’s (2008) measures of “depth of interaction”, categorizing teacher conversations (both during formal and informal interactions) as low-depth (focused solely on pacing of lessons and lesson plans) or high-depth (centered around discussions of student ideas around key mathematics in lessons, e.g.), are applicable to high school teachers. In the West High teacher stories, responses to the question “why did you seek help from that particular person?” were centered around the more familiar, lower level dialogue routines of pacing guides, curriculum maps and textbook/standards mapping documents. Many of West High’s narratives revolved around their need to gain access to curriculum materials, technology, and more time, as well as the challenges they faced as they interacted with administrators. Teachers in all interviews did broach the subject, but in different ways.
Teachers in the higher level courses discussed having to seek help regarding the mathematics involved in a new course, but this was most typical for courses in subjects (such as Statistics) in which teachers had not interacted with the content since their college courses. Special education teachers all admitted needing help with understanding the mathematics that they were expected to teach (and for which they had had few college courses) and sought help usually from the teacher with whom they were paired for inclusion courses. The remaining teachers stated that they felt all teachers were equal in their content area expertise and thus typically sought out the teacher who had taught the course before them.

In these cases, where existing collaborative and instructional practices are not questioned or examined, teacher collaboration has been found in some studies (e.g., Little, 2003) to constrain teacher growth more than encourage it due to the tendency of groups to conform to practices that are familiar and which have been successful for them in the past. As discussed previously, the departmental structure of high schools, while lending itself to efficient distribution of labor, also works to reinforce pre-set norms for interaction, including who has the highest status in the group and whose ideas are valued and carried forward (Grossman & Stodolsky, 1995; Siskin & Little, 1995). The attitude of some teachers in the study of waiting out reform efforts until the next “flavor of the month” comes along is evidence that there was an attitude in the department of holding on to past practices that had worked for them in the past, and that the group had a high level of agreement when it came to events and stories which they considered “critical.” This could be evidence that the teachers at West High had a high level of internal
consistency and were in danger of isolating themselves from needed resources external to their network.

Patterns of interaction between high school mathematics teachers differ markedly from those of their peers in other departments, particularly the humanities (Grossman, et al, 2001). While humanities-oriented departments aim for divergent ideas to be shared, mathematics teachers are accustomed to axiomatic, parsimonious solutions, and seek similar resolution in their group discussions. Additionally, the authors point out, mathematics as a subject, unlike language arts, is not synonymous with “expressions of the self” or even with being able to express personal unease with certain aspects of mathematics (as in math anxiety) (Grossman, et al, 2001). Communication patterns between these different teacher groups matter, and offer additional insight and challenges for systems that see the value of tapping into those aspects of social capital (e.g., trust, depth of interaction) which lend themselves to teacher self-evaluation and identification of strengths and weaknesses.

Finally, the highly specialized nature of mathematical language makes it an important factor in the consideration of who is available to teachers for professional assistance (Horn, 2005), as well as the nature of the conversations that occur between them. Teachers, faced with enacting multiple innovations, are unable to interpret or stay focused as a collaborative group on why the reforms were enacted in the first place (Louis, Marks & Kruse, 1996) thus leading the group most often to conversations that don’t involve deeper issues which would lead to transformations in teaching. For these
reasons, involvement of teachers in governance and policy enactment decisions may be more important in high schools where there generally is “an absence of common intellectual experiences” (Louis, Marks & Kruse, 1996, p. 784) that require the reflection and reflective dialogue that can lead to group cohesion and enactment of a common vision. Although many in this study did discuss the need for more time to collaborate, it was unclear as to what they would use this collaboration time to accomplish. Reactions to the Peer Observation Lesson were generally positive and seen as affordances in their learning, but conversations about what they learned there tended to focus on the teachers’ ability with students, their methods for organizing their room and lesson, and the pace of the lessons.

There was some evidence, however, that the focus of teacher conversations had begun to shift, perhaps as a result of their extended time together over the course of the MSU project (which was aimed at increasing their mathematics content knowledge) and their ongoing district-sponsored professional development. Teachers described in a few cases conversations about new teaching methods and how they had received help when implementing new inquiry-based methods. What was hoped was that the group had begun the process of shifting their conversations away from that of “how to pace the textbook lessons” to one of “where is the mathematics in this lesson and how should students engage with it?” An interesting question, which was not a focus of this study, is the extent to which this conversational shift took place and how such a shift in this culture might sustain itself without external intervention.
Coburn & Russell (2008) found that patterns of interaction detectable in the district professional development had been passed on and mimicked in coach-to-teacher interactions, and then again in teacher-to-teacher interactions. What values were subsumed by similar groups at West High, including those dialogue patterns from administrators which emphasized authoritative decision-making and non-questioning of mandates, and to what extent did these interactions play out in district classrooms in teacher-to-student interactions? In middle schools, the Coburn & Russell study found this pattern to be true, where math coaches served as a bridge between district administrators and schools, and between curriculum disseminators and teachers. In high schools, who plays this role? Specifically at West High, was this role of translator and intermediary played by administrators, external resources (the MSU professors), the department chairs, or by those who were “unofficially” deemed the ones who best interacted with administrators? Would the teachers at the center of their social network (detectable through their social network analysis data) be the ones who were informally playing this role? In a high school setting, without coaches, and where subject area expertise is a major part of teacher identity, who most influences a department’s “level of incongruent talk” (Coburn & Russell, 2008, p.220) and depth of interaction?

These questions matter, given the need for opportunities for what Horn and Little (2010) called “rough talk”, where teacher groups were able to work through, using differing levels of talk, several layers of meaning-making of how their students reacted to them and vice versa. In a dialogue rich with revisions, questions and uncertainty, the teachers in their study worked together through various scenarios of practice to
eventually arrive at a generalization that could serve as a model for future teaching episodes. In this case, a teaching model was being co-constructed by the teachers in the group as they worked out the details of the interactions with their Algebra students. At West High, teachers did not have norms or routines for a level of professional interaction that might have led to new and revised models of teaching, which also leads to a final point: nowhere in the interviews did teachers in this study indicate that they themselves were thinking about the nature, depth or content of their professional interactions. The transparency needed in an organization to successfully pass on models of expertise from expert to apprentice (Lave & Wenger, 2002) did not exist here.

A Familiar Story – The Cycle of Futility in High School Reform Efforts

Beyond the detection in these teacher narratives of the four dimensions of social capital, analysis led to a common narrative thread in the groups’ interpretation of their professional lives. The groups’ disposition toward the reform process itself was one that can best be described as “resigned to failure”, or of repeated reform efforts that had proven to them that their best efforts at meeting the mandate had been futile. Two vignettes, repeated by several of the teacher groups, serve to illustrate this point.

In the first story, Chris and Sid are talking about their frustrations with the way administrators make decisions. The school had received a donation of five SmartBoards, and needed to make a decision as to which teachers should get them installed in their classrooms. Initially, the teachers received an email asking who was interested in receiving the equipment, and asking them to explain how they would use it. Several
mathematics teachers responded, feeling that they would be given serious consideration due to the increased need for students and teachers to be able to display dynamically important mathematical concepts and to have the ability to interact and see immediate results from manipulating certain variables or mathematical elements. Several days after the initial email, the staff received a follow-up email from the building principal that said that the decision had been made to give the technology on a first-come, first-served basis. Chris initiated the story with the orientation of “this is going to sound like a joke.” In her interpretation, neither teacher expertise nor classroom needs were considered, and teachers were not consulted. The decision seemed to her to be random and not based on any sound educational principles. Trust between teachers and administrators was further eroded, there was no consideration of teacher ties (if, for example, a group of teachers might be situated to be able to assist one another in learning and using the technology) nor of teacher content knowledge or the professional conversations (depth of interaction) might have around the implementation of this new technology. Administrators were not included in this study, so there is no account of how the administration actually made their decision, but in terms of teacher perception, and the opportunity to take advantage of teacher expertise in increasing the school’s social capital, this was a missed opportunity.

In the second story, teachers were required to define collaboratively their “guaranteed and viable curriculum” (an adaptation from Marzano, 2003) and then to write common assessments matched to those key, agreed-on unit topics. While the mandate did have the positive impact of causing teachers to work together and to come to
agreement on what they believed was important mathematics (including a chance for the special education teachers to receive informal tutoring in their content knowledge), the exercise as implemented was focused on copying the units in their textbooks (unexamined for the importance of the content) onto online forms required by teachers to complete (a very time-consuming process which had more to do with mastering the technology). Common assessment writing, always rushed due to a lack of time during their professional development time together, consisted of either downloading released state test items or writing/copying items of their own. Due to a lack of additional time in their daily schedule, and the subsequent requirement that teachers hand-score the open-response items on the tests and then input those results into a database (during their individual planning time), teachers never had the opportunity to discuss the results of the tests together, nor even to examine whether they felt the test item itself measured the concept the way they expected it would. Instead, the program left them feeling frustrated, powerless, and disillusioned about the process. It developed into an exercise of “keeping their heads above water” (3:17), rather than an opportunity to genuinely learn about their students’ knowledge of mathematics and where they might need to intervene. Again, at issue here was trust of administrators, the breaking down of group ties to one another, a byproduct of low-level teacher interaction, and no time for discussion about the meaning of mathematical content or how their students might interact with the mathematical ideas contained in the assessments. This was another missed opportunity, where social capital resources could have been accessed in order for teachers to be able to
find help where they needed it based on an honest assessment of their own students’ results.

These stories were just two of many that were shared as a source of frustration for the mathematics department. After years of cycling through different administrators and reform initiatives, these episodes led to the numbing of teachers to any positive effects that might have been realized, of their decisions to “wait it out”, to do the minimal amount of work required on the implementation of the reform: “I’m going to do what I need to do, and…if you wait long enough, it’s going to go away, right? / …here’s the new thing, but…/Right, eventually it’s going to work its way back around and it’s going to be the same old thing (as) in the past, so…” (5a:28). This constant cycling between new administrators, identifications of where they needed to improve, new reform programs, teacher efforts, and then finally abandonment of the reform contributed to teachers identifying themselves as the stable ones in the system, “the only constant “ (5a:29), the ones who make it work, no matter the intended outcomes.

This “flavor of the month or year…” (5a:38) approach to instructional reform led to low trust of administrators, fragmented school relationships, poor interpretation and implementation of reform initiatives (separate from their actual value), and lower depth of interaction between teachers. Teachers related feelings of intense stress and frustration due to their inability to meet the demands of both the classroom and the new administrative mandates – no time and constant change. Their conversations, as a result, were focused on sharing resources to meet the administrative demands quickly and in
time (test questions, test data, curriculum maps, curriculum guides, new course descriptions, etc), often in response to administrative mandates that were shared in “top down” fashion. Niesz’s (2010b) description of the conflicting forces of high-stakes reform and market-driven accountability models, both based on constructing and upholding specific school-improvement images for public consumption, is relevant here. In her study, administrator efforts to meet high-stakes accountability measures (such as test preparation and standardized test practice) resulted in less time for teachers to pursue other additional mandated reforms (those focused on project- and inquiry-based learning and which lent themselves to the school’s positive image in the community). These dual demands on teachers left them feeling conflicted, pressured, and pitted against one another. Administrative decisions privileging the high-stakes testing model took precedence over teacher efforts to innovate, and thus structures and resources to support innovative teaching, ironically those which the principal promoted as definitive of their school culture (teacher collaboration, ongoing professional development, etc) were not made available to most teachers in the school setting.

In the face of these competing demands, teachers at West High indicated that they navigated the often conflicting demands they faced by relying on the trust relationships which they had developed within the department. The result was a high level of internal agreement and consistency of narratives relayed about trust and structural ties to one another and to administrators, but limited numbers of external links (Woolcock, 1998) and limited understanding of, or ability to access, the social capital resources available to them. In these situations, when teachers often fall back on familiar
interactional routines in their dialogue patterns (Little, 2003; Rousseau, 2004), groups risk becoming myopic (Woolcock, 1998) as they fashion coping mechanisms to deal with multiple stressors on their department, not the least of which are rapid, multiple, disconnected reform efforts. Evidence of this cycle surfaced in the teacher narratives at West High, where it was noted that teachers did not ask for specific supports which could have helped them to complete the tasks required of them. Was this because the teachers felt marginalized and that their professional knowledge was not respected, or was it because they, unaware of their level of social capital resources, were unable to name their group strengths/weaknesses and needs, and thus unable to advocate for themselves professionally?

This cycle of multiple reforms implemented poorly and teachers’ responses to them leads to an additional question: is there an additional negative residual effect of teacher attitudes towards not just specific reform efforts, but towards any reform effort that may (or will) be employed in the future? A negative teacher disposition towards change, coupled with low trust of administrative leadership, and no capacity to identify what is needed for a change initiative to be successful, is a recipe for low teacher self-efficacy (Pajares, 1996; Wheatley, 2005), poor implementation of new ideas (that have succeeded elsewhere) and a continuation of the cycle of failure. This phenomenon of the educational system’s resistance to change (Cuban, 1990; Supovitz & Weinbaum, 2008), when framed in terms of a lack of social capital resources, is seen to perpetuate the cycle and culture of individualism, conservatism and presentism described by Lortie (1975) and expanded upon by others (e.g., Hargreaves, 2010).
What might interrupt this cycle? If a district, state or federal goal is to increase student learning, investment in one of our educational system’s most valuable assets, teachers (or “nation-builders” as the South Koreans and Obama call them (Obama, 2011)), could an additional dimension added to social capital models shift familiar narratives away from schools as broken places (Suster, 2010) to one of schools as rife with resources and assets?

**An Additional Dimension of Social Capital – Group Self-Knowledge**

Analysis of data at West High indicated the need for an additional dimension to be added to existing social capital models (Figure 11).

![Figure 11: Group Self-Knowledge as Additional Dimension to Social Capital Model](image)
Called “Group Self-Knowledge”, this dimension recognizes the value of teacher groups being able to identify and analyze their social capital resources, and then to subsequently use this knowledge to inform policy developers and decision-makers of those needs. In this study, teachers struggled with discussing the level of expertise in others, whom they would NOT go to for advice (and why), or even a way that they might see each others’ expertise as an asset to them as a group. What is imagined here is the intentional development of not only technical language which describes the level of social capital, but also tools to allow teachers to see how their group social capital nodes and connectors are related.

While solid tools exist for teacher groups to assess and discuss their level of collaborative behavior (DuFour, DuFour, Eaker, & Many, 2006; Learning Forward, 2011; McLaughlin & Talbert, 2006), these tools address only one aspect of the social capital models in existence, that of “trust” or “motivation”. Left unexamined in these tools is the number and strength of ties within the group, the groups’ collective knowledge (pedagogical, content and pedagogical content knowledge), and the groups’ propensity to relate to one another on a deeper level around issues central to student learning and understanding. The movement towards professional learning communities proposed by McLaughlin & Lieberman (1992) and popularized by DuFour (2004; 2006) and others (e.g., Marzano & Waters, 2009) relies on teacher discussions around student data. While well-meaning, and meant to focus teachers’ attention on issues of student learning and away from the more “surface” issues of curriculum pacing and curriculum guides, the implementation of this reform by many organizations often has taken the form
of yet another administrative mandate, with little to no teacher input as to how or what
should be focused on in teacher professional meetings and for what purpose (Levine &
Marcus, 2010). In order for teachers to be able to generate solutions to the problems they
face, what is required is a looser governance structure from administrators but with group
and individual teacher accountability built in (Scribner, Sawyer, Watson, & Meyers,
2007) that encourages the strengthening of both internal and external ties.

The addition of this additional category to existing social capital models honors
group identities that may be related to subject matter and content (such as at the high
school level), are influenced by the context which surrounds the teacher team or group
(such as the ways in which high school mathematics teachers communicate with one
another), and the larger teaching culture within which teacher teams operate. For
example, if a teacher or group believes that they need to move to a more interactive style
of teaching, where students play a more active role in the learning process, but the
principal and/or the parents have different beliefs about mathematics and learning, there
is potential for tension and a possibility of mandates handed down which conflict with the
instructional practices on which the group is focused. How can teacher conversation
move to a “deeper” level (Coburn, 2003) if teacher teams are not supported or are
actively negated? And conversely, how can classrooms become sites of interactivity and
generative thinking if teachers themselves did not learn this way and belong to school
communities that support a very different kind of student/teacher relationship (Hoban,
2002; Lortie, 1975)?
From a governance perspective, strong leadership has been shown to be a necessary condition for a system to be able to support and sustain its own growth (Priestley, 2011; Moolenaar, et al., 2010; Weinbaum & Supovitz, 2010). However, viewing the system or the teachers within the system only through a lens of individual content knowledge or pedagogical knowledge does not recognize the importance of “capacity” – the capacity of the system to recognize, translate and implement new ideas and new ways of approaching teaching and learning. Structural factors, relationships, values and attitudes all have a role to play in defining “capacity” for any one site, and impact teachers’ ability to access new or alternative resources (Priestley, 2011). School leaders must provide support to the system in the form of adaptations to not just physical resources, or expectations of increased human capital (group and individual knowledge), but also in the group’s social ability – its ability to interact with one another as well as to analyze their own levels of social capital.

Revisiting the two stories related earlier in this chapter, an analysis of their social capital resources by the West High teachers could have led to an organized, focused assessment which would potentially have informed the administrative team when the additional physical capital resources (the Smart Boards) became available. Thus, an administrative decision about how to distribute physical goods would have been informed by their knowledge of the “system” – the mathematics department’s level of professional expertise, who is as the center of their network with regard to knowledge about technology, who is connected to whom, and who in the network is adept at making sure that expertise gets passed on. Likewise, having the language and tools to identify the
existing expertise in their department and analyzing what knowledge they would need to be able to make the writing of their common assessments an effective exercise would have informed the district and building leaders of specific needs of their teachers so that the implementation would have been more successful. These resources might have included more time with one another to be able to discuss student work and to come to agreement on how they graded each assessment, assistance from external experts who had experience with high schools and common assessments, or additional technology to be able to share results in an organized way and then collaborate about those results. These scenarios, which depend on group self-knowledge, lead to an emphasis on teacher conversation that moves the group towards “generalization” of high leverage practices (Ball & Forzani, 2011), the “normalization” of their interaction routines (Hargreaves & Shirley, 2009), and the way in which teachers interact with one another professionally. These affordances in teacher learning (Horn & Little, 2010) present teachers as agents involved in their own teaching lives and decisions about how to develop themselves further professionally, particularly as situated in response to their growing understanding of complex instructional situations.

A system that allows teachers to describe and analyze their own social capital places at the center of their professional work together the “normalization” of communication patterns about where interactions should be focused (problems in teaching) and how the group approaches those discussions (Horn & Little, 2010; Horn, 2010) –– in other words, a system that focuses their group activity on a crucial aspect of their social capital, “depth of interaction.” This creation of what Horn & Little (2010)
called “interactional space” places teachers at the center of attention towards alternative explanations and reasoning about their own previously unexamined beliefs and emotions with regard to students and about mathematics, a place where “rough talk” (Horn & Little, 2010) and shared expertise is expected, particularly with new teachers.

The space for generating new knowledge (Franke, Carpenter, Fennema, Ansell, & Behrend, 1998; Niesz, 2010a) requires such work as teaching replays and rehearsals (Ball & Forzani, 2011; Wilson & Berne, 1999), which is one vehicle that activates teacher learning while privileging their interactions with one another (Horn, 2010; Lampert, Beasley, Ghousseini, Kazemi, & Franke, 2010). This work, in turn, implies the need for a professional vocabulary to be able to discuss the social capital resources – knowledge level, trust, number and location of links in their network, depth of their professional conversations – which teachers have available to them, or which they need to seek out. In terms of social capital, this lack of a language for identifying or analyzing group expertise acts as an inhibitor to the dissemination of that group’s “ability” or knowledge. Without this language, teachers and administrators are essentially stabbing in the dark for solutions to momentous problems, hoping that the programs they adopt, often having been effective in other similar school settings, will be effective in their school as well.

Numerous studies, however, have now revealed the folly of this thinking, making clear that innovations are always interpreted and adapted uniquely and locally (Supovitz & Weinbaum, 2008), based on the resources available to that organization – the student population, the parent expectations, the knowledge and ability of its teachers and administrators, and the ability of the organization to make available its resources to its
members (its social capital) (Frank, 2004). Through this lens of social capital, not only is the flexibility and ability of a group to pass on information seen as critical, but its own knowledge of how and where its component resources are located or needed is seen as equally important. Group self-knowledge, then, presents itself as a necessary dimension to a department’s ability to access resources.

**Significance of the Study**

The central finding of this study, that social capital models would be enhanced with the addition of the dimension “Group Self-Knowledge”, leads to four significant impacts on educational systems: a “systems” view that privileges the knowledge of the group and disrupts teachers’ tendency towards individualism, presentism and conservatism (Lortie, 1975); an altered vision of the role of teachers in the system; a shift away from a deficit model of teaching towards a vision of educational systems as collections of assets; and an educational model that operates from a standpoint of reinvestment and cycling of vital resources back into itself.

When one accepts the premise that “a collective group has more knowledge than any one individual member” (Grossman, et al., 2001, p. 974) and is an emergent, complex system which is “not just the sum of its parts, but the product of the parts of their interactions” (Davis & Simmt, 2003, p. 138), then the ability of a teacher group to be able to analyze its own social capital resources becomes more necessary. Using a systems approach in shaping school reform efforts upsets the cycle of teachers falling back on familiar interactional and instructional routines to the extent that it creates a conduit for
constant assessment of the system and of its capital resources. Although social capital is produced “in action” and cannot be generated directly through policy (Smylie & Evans, 2006), the conditions which allow for increased social capital can be created by school leadership. Generated from within, from the bottom up, social capital is directly connected to the effectiveness of a reform initiative or a district’s ability to implement new and improved approaches to teaching and learning. Explicitly targeting social capital resources would lead to a culture of more focused interventions and decisions about infusions of capital (where and which type are needed), ultimately leading to a system’s requisite “dual focus - on its own professional learning, and on the social group as the crucible for individual change” (Grossman et al., 2001, p. 975).

Second, viewing social capital as critical to the health of a system leads to a different conception of the role of teachers in that system. Teachers, as the arbiters of social capital, contribute to the health of the system by generating new knowledge (Cochran-Smith & Lytle, 1999; Franke et al., 1998; Niesz, 2010a), participating fully in the creative process of teaching and scrutinizing their own teaching continuously and scrupulously. As professionals in this setting, teachers are expected to uphold standards of learning – their own as well as the groups’ – using creative approaches to new challenges, relying on the expertise of those within their immediate network, and knowing where and how to access the expertise needed externally from their network (Berry, 2010). This is significant, at a time when many view “good” teaching as something that can be scripted and regurgitated, or when respected administrators such as Michele Rhee claim that “cooperation, collaboration, and consensus-building are way
overrated” (Leana, 2011). This is also in keeping with international teaching models, such as those in Japan (Stigler & Hiebert, 1999) and Finland (Partanen, 2011), that privilege teacher learning and teacher expertise with the knowledge that this, in turn, leads to the greatest gains in student achievement. In those countries, as the recent PISA report pointed out, social capital is used as an accountability mechanism. In the place of national tests is a system of teacher accountability in which “all the teachers in the school know just how good or bad the other teachers’ teaching really is because of the lesson study process” (OECD, 2011, p. 151).

This vision of education comes much closer to what Hargreaves & Shirley (2009) have called “The Fourth Way” in which teaching expertise is defined in terms of teachers’ talents, passion and purpose, and where a continual focus on mindful and creative approaches to teaching leads to the integration of existing teaching repertoires into new reforms through a system of collective responsibility. Creativity is honored and expected here, as is participation in the process, a realization of Dewey’s vision of the role he believed teachers needed to play in a participative democracy (Dewey, 1916). This social capital approach also recognizes the assets inherent in the system, or the system’s capacity (Smylie & Evans, 2006), which then allows for decision-making and policy to be formed mindful of the characteristics of groups that are complex, self-organizing, and emergent: internal diversity, decentralized control and neighbor interactions (Davis & Simmt, 2003). Expecting educators to collaborate creatively and generate new knowledge realigns teachers with the reasons why they initially went into teaching (Lortie, 1975), and combats recent statistics showing teacher job satisfaction at
its lowest level in twenty years and that more teachers each year are choosing to leave the profession, particularly within their first five years of teaching (Markow & Pieters, 2012).

Third, this research represents a shift away from the all-too-familiar deficit model of education in which research questions and public perception focus on what is wrong in our educational system and how it can be fixed (Hargreaves & Fullan, 2012; Suster, 2010). In its place are efforts by teachers to describe, analyze and improve their social capital. This approach implies a vision of education as a system of assets, each school its own unique blend of these assets, and each school having its own unique strengths. A knowledge of a system’s strengths can lead to the ability of teachers and administrators to make more informed decisions about the need for additional resources, and the ability to target those resources in the areas where there is the most need, and where the investment will yield the greatest results. With teachers invested more in the process, there is an increased level of teacher efficacy (Wheatley, 2005) and consequently, teacher motivation to put forth effort towards continuous learning (Pajares, 1996). This “capacity for reform” (Spillane & Thompson, 1997, p. 199) is closely connected to a school’s level of human and social capital, and shifting our models of educational success to incorporate these notions of capital leads to a vision of cognition (Putnam & Borko, 2000) and leadership (Arhar & Crowe, 2002; Chrispeels, Burke, Johnson, & Daly, 2008) as distributed across the system, away from lists of resource deficits and quick-fixes and towards one of resource assessment: what the group knows and needs to know, and where their knowledge, ties and conversations are solid and where there is a need for additional improvement. This is ultimately a vision of “schools as professional
workplaces for adults” (Bryk & Schneider, 2002, p. 135), wherein teachers’ complex knowledge, seen as bound to the learning of students, becomes a driving force behind policy and reform decisions.

Finally, this model creates a vision in which the assets of a system get developed, honored, and reinvested back into the system (Adler & Kwon, 2002; Ahuja, 2000; Frank et al., 2004). For teachers, the model implies that they will have knowledge of how they are contributing and where they need assistance, as well as resources as to where they can gain that knowledge. For administrators, the model provides information about what resources are needed, where they need to be applied, and who/what has the greatest impact on the learning of a system. For researchers, education professors and teacher professional developers, the model provides an assessment of social capital which can guide research questions or interventions designed to increase teacher capacity as professionals, and to increase the educational system’s capacity to acquire, share and generate expertise. For any of these groups, viewing teacher networks and teacher network leaders, as purveyors of the overall vision and goal of the wider organization would benefit the system as a whole, given that reforms are always interpreted and filtered locally by the teachers who are expected to enact them (Louis, Marks & Kruse, 1996; Supovitz & Weinbaum, 2008). Alignment of goals between those of the school or district and those of the department, which involves viewing teachers as sources and consumers of social capital, would be beneficial to the larger system (Louis, Marks & Kruse, 1996). The level of social capital resources in a system is thus an outgrowth and reflection of the vision of the organization as a whole (Adler & Kwon, 2002).
Holding social capital at the center of decision-making leads to a central question: how tightly coupled is the district vision for change and reform to departmental or teacher network belief? Without an answer to this question, teachers are left to rely on what they know (their own beliefs) and to draw on departmental norms and beliefs in order to move forward (Resnick & Glennan, 2002). Additionally, as social capital is reinvested back into the system, it increases the level of human capital, impacts decisions about physical capital, and continues to grow the levels of existing social capital, which are in turn re-invested back into the system. Social capital models combined with assessment of physical and human capital resources lead to a vision of teacher conversations and collaboration not as frivolous or a luxury few can afford, but as a central, essential component of a system that is able to continue to learn, grow, adapt, and meet the demands of a rapidly changing world (Davis & Sumara, 2006).

**Limitations of the Study**

Limitations of this study included the small sample size (14 teachers) and results that should be interpreted while considering the context and setting of the teacher group – an urban district in a high poverty smaller city in the Midwest, high administrative turnover, and a relatively stable teacher population. Teachers were matched into high-trust pairs for the gathering of interview data in order to insure that the narratives shared were trustworthy and representative of the views of those who shared them. However, anonymous written data revealed additional information that was not shared in any interviews, pointing to a possible additional limitation of using high-trust teacher pairs: teachers may have been less likely to share some of the negative opinions they had of
others’ expertise in the department. Finally, it is always the case that the benefits of a qualitative study also can be its limitations – the researcher’s involvement as a participant-observer, while allowing trust to develop and allowing for access to and verification of teacher narratives, meant that researcher bias in interpreting the data had to be considered. Additional measures were included in data collection and analysis to minimize possible researcher bias.

**Implications and Future Research**

This study proposed that a social capital model which includes a dimension of “group self-knowledge” could be instrumental in moving systems of learners to increase their capacity to incorporate new knowledge and towards more informed decision-making by teachers and teacher leaders. Further research needs to be conducted in order to determine what a “needs assessment”, including the system’s strengths and weaknesses, would involve. How does a system gather, display and analyze reliable data about the level of expertise in a social network? A theoretical framework for a study that values teacher knowledge (Cochran-Smith & Lytle, 1999) would ideally be able to assess teachers’ trust levels in their social network as well as the strength and number of their internal and external ties. The question of who is included in high school teacher professional networks is of particular interest since high school departments can both inhibit and afford teacher access to resources (Weinbaum et al., 2008). Additional investigation into how social network data can be visualized is needed, as well as further research into how individual teachers and school leaders react to the data. How is trust established and maintained in a group that has been charged with analyzing its own level
of expertise? What additional interpersonal and intrapersonal norms are needed for group self-assessment to be successful and what distinctive challenges or information arise as a result of teachers interacting in purposeful ways to increase their levels of social capital? What vocabulary, dispositions, and tools are needed for teachers and administrators to be able to conduct this type of assessment successfully?

This study also offered a research methodology that future research may utilize if the research aims to privilege teachers’ level of social capital, both in the data gathering phase as well as for purposes of analyzing data. Teachers and researchers see and define educational problems differently (Wheatley, 2005), so using information gathered through social network analysis or through the use of known strong ties allows for a research design which reifies the concepts of trust, professional ties, level of communication and group self-knowledge. The design includes solid measures of validity (trust amongst network members is established up front) so that qualitative data is more likely representative of the group who shared it. Finally, the design offers an alternative tool for teacher educators, administrators and planners of school-level professional development who want to understand existing teaching practice and the values inherent there before designing or implementing reform. This process, which Grant, Peterson & Shojgreen-Downer (1996) called “backmapping”, informs leaders and decision-makers within a system of the school structures that would best support teacher learning and the development of increased social capital.
Summary

High school settings, more complex than elementary or middle schools in terms of daily schedules, staffing, and teacher cultural roles (Louis et al., 1996), face more challenges when they attempt to implement reform. A governance structure that is top-down in nature (Talbert & McLaughlin, 2001; Giles & Hargreaves, 2006) and teacher communities pre-organized into tightly-bound subject departments (Little, 2002) often result in a familiar, ineffective cycle of instituting drastic reforms quickly (reforms that most likely have been effective at other high schools or proven in a K-8 setting), expecting teachers to implement the reform without adaptation or innovation, and then expecting results (Supovitz & Weinbaum, 2008). The narratives in the study were shared by a group of teachers who were under extreme pressure from new local, state and federal mandates and from threats of job loss due to low state scores and a low overall state school ranking. An extremely high turnover rate of administrators in both the high school’s front office and in the district’s central office compounded the issues for teachers who had to manage the resulting rapid-fire demands of continuous new reforms.

The teachers in this study identified themselves as “the constants” in the system, the ones who stayed and provided the stability and longevity required for learning and change to occur. Unfortunately, their repeated experiences with reforms which were shallow, short-lived, singularly-focused and poorly implemented led to an attitude of negativity and resistance towards change efforts in general and a stance of “wait it out until it goes away.” Too often, their narratives said, the teachers had experienced administrators with ideas for reform and improvement of student learning that led to
plans for implementation involving no input from those who had the most knowledge of their students or of the history of previous reform efforts and their resultant successes or failures. A significant finding with this department was that they were unable to define, discuss, assess or advocate for their own needs as learners in any substantive way.

A social capital framework provided a solid research design which allowed for the reification of the key dimensions of the construct: structure and ties within the network, trust, ability, and depth of teacher interaction. Research questions in the study were framed in terms of access to resources and how best to procure those resources, and teacher narratives revealed that the group was aware of and able to define issues around trust and structure within their network. There was much less discussion or acknowledgement of the remaining dimensions of social capital: group ability and depth/content of their professional interactions. Teachers had no vocabulary, interactional routines, norms or other tools which could assist in the uncovering and analysis of these important social capital resources. Faced with the multiple challenges of group collaboration, increased academic rigor, more intensive standardization of assessment and required content to be taught, and pressure to change their pedagogical approaches, the group encountered practices that were not only new to their high school classrooms, but posed a significant threat to the familiar and dominant high school departmental culture (Grossman et al., 2001).

The study found that there is a need for an additional dimension to be included in existing social capital models. Defined as “Group Self-Knowledge”, I describe this
construct as a way for a group to be able to detect, define and assess its capacity for change. Given that the enhancement of teacher agency is a necessary condition for innovations in schools to take root (Priestley, 2011), a system would benefit from developing a group’s ability to identify, describe and harness its existing knowledge- and skill-base. If indeed a system reform aims for its “actors” (teachers) to gain more human capital (content and pedagogical knowledge) and to gain the most benefit from investment in physical capital (additional financial resources and adaptations to building schedules, teacher time, etc), then a more intensive focus on the system’s social capital resources is needed. The ability of a group or network to assess their social capital, including the use of social network analysis data, is essential in order for a system to be able to determine the level and location of need, and to match those needs with the specific resources (physical, human or social capital) that would be the most likely to lead to conditions in which the system can learn, adapt, grow and change (Davis & Sumara, 2006). Social capital models offer constructs which can assist in social capital analysis, and which, with the addition of the element “Group Self-Knowledge”, could lead to significant impacts on educational organizations: a “systems” view that privileges the knowledge of the group and disrupts teachers’ tendency towards individualism, presentism and conservatism (Lortie, 1975); an expectation of professionalism, creativity and problem-solving from (the teachers within the system; a shift away from a deficit model of teaching towards a vision of educational systems as collections of assets; and an educational model that operates from a standpoint of reinvestment and cycling of vital resources back into itself.
Ultimately, the worth of a system’s social capital depends on how tightly a vision for reform fits with the social structure that supports it, which is itself a manifestation of what the system and its leadership values. Effective deployment of social capital cycles valuable resources back into the system – resources that are themselves altered as they go through iterations of teacher interaction and interpretation (Supovitz & Weinbaum, 2008). Through the professional work of analyzing trust relationships and network ties, examining professional interactions, and assessing their own knowledge, teachers and administrators share in the responsibility for defining and interpreting the vision of the system, assuring that their professional efforts are in keeping with sound educational philosophy. They create what Wenger (1998) called “a social infrastructure to foster learning”, thereby purposefully building organizational structures that support and foster the conditions for learning in existing social networks (Coburn & Stein, 2007).

This work will not be easy. A postmodern world advocates for learning communities at the precise moment when the vestiges of a “modernized, micromanaged, and politicized educational world” (Giles & Hargreaves, 2006, p. 153) are being deployed in the name of accountability and progress. A social capital approach to school improvement inserts itself into this conversation as a necessary condition for the vision of effective schools and increased learning to finally be realized.
APPENDICES
APPENDIX A

SCRIPT TO RECRUIT TEACHERS FOR STUDY
APPENDIX A

Script to Recruit Teachers for Study

“Hello, High School Mathematics teachers. This year, I have been helping as a research assistant on the Mathematics Partnership Project with Dr. M and Dr. C. As part of my doctoral program, I am studying how high school mathematics teachers work together in community and how this impacts their professional lives. Specifically, I am interested in your views of the resources and expertise that help you as you examine and try to improve your teaching practice. Gaining access to these resources through social interactions is called “social capital” by some, and this is the focus of my study: your perceptions and experiences with what is being called social capital.

As a participant in this study, you will be paired with another teacher in your department whom you have identified as someone you’ve sought out previously for professional advice. With this teacher, you will be presented with a series of questions that you’ll ask one another. I will audiotape your conversation as you discuss these questions together, and as you reflect on your experience this year in your classroom and in collaboration with others in the Mathematics Department. The interview will occur at a time and place that is convenient to you and your partner teacher, and will last approximately 2 hours.

This study is an off-shoot from the work you’ve been doing with Midwest State University this year, but it is separate. The attached chart describes the relationship of this study to the project, and to the preliminary research study I conducted in the spring
of this year. Your participation in the project does not mean you must participate in this study, nor does non-participation in this study impact your activities or reimbursement with the project. Because the project covers only professional development that is specified within the project, your hours spent during the interview will not count towards your project hours, and cannot be compensated by the project. However, I appreciate very much your time and know that you are busy. I am offering a $10 gift card to Panera in appreciation.

What are the benefits? You have much to offer. The research is being conducted with the ultimate goal of increasing knowledge about what teachers consider to be important resources as they examine their practice collaboratively. Work on this project will allow you, as a teacher, to define those parts of your practice that are important to you, thus informing others who do not have access to the details of your teaching experiences. This work has the potential to impact the kinds of resources that might be made available to high school mathematics teachers once the findings are made public. The interview process with a peer teacher affords you a chance to reflect on your teaching practice. In addition, participation in this study has the potential to increase the knowledge of others, including teachers, administrators and policy-makers, nationally and internationally, as they make decisions and set policy around high school mathematics teaching.

Additionally, complete confidentiality is assured. No one outside of the Midwest State research team for this project (myself and the 4 professors who serve on my dissertation committee), including school administrators, will have access to information
from this study, including your interviews, and the teachers you identify as those you go to for professional advice. All names in the final paper will be pseudonyms.

Thank you for considering this request.
APPENDIX B

QUESTIONS ASKED OF TEACHERS TO CREATE INTERVIEW PAIRS
Appendix B

Questions Asked of Teachers to Create Interview Pairs

Hello Teachers. Thank you for agreeing to participate in my dissertation study and for signing the consent forms. Please let me know:

1. dates/times you are available from this list: (potential dates listed here). (include if you are available in the evenings - we can find a spot at Midwest State County Campus).

2. Your cell phone number and/or home email (whichever is the best way to get in touch with you) - to confirm times, places, etc

3. Who are the 3 people in the department you consulted the most for professional advice (something about your teaching, your students, etc)?

4. Who are the 3 people in the department who came to you for professional advice the most often?

These responses are confidential - and will be used to create the interview pairs.

Thank you.
APPENDIX C
SCRIPT TO INTRODUCE TEACHERS TO TEACHER INTERVIEWS
AND INTERVIEW QUESTIONS
Appendix C

Script to Introduce Teachers to Teacher Interviews

Introduction: “I am studying what high school teachers perceive to be important resources for them to be successful in their work, and the social contacts you feel best help you to gain access to these resources. To do this, I’m asking you to interview one another, to have a conversation with one another using the questions listed below. Through the stories that you tell one another, I want to study what matters to you as a teacher when it comes to the resources you need when you are looking at improving your teaching practice.”

“Please use the questions below. One of you will ask the other a question (any one that you choose). Listen and respond as the person responds to the question. Feel free to have a conversation, but allow the “story” to reveal itself. Then switch roles. The second person asks a question (again, any question from the list), while the other listens and responds as appropriate. I will listen as you talk, and may, at times, as you to elaborate on a story or experience. I will stop the conversation after approximately two hours, if that is necessary. Do you have any questions? OK, thank you for participating. I’m turning on the tape recorder. Choose one of the questions below to discuss with your interview partner. You can begin.”
**Interview Questions**

1. Talk about a time when you had to change something about your teaching. What happened? Who or what helped you with this?

2. Talk about a time when you felt that you needed help with your teaching (a time when you were frustrated, in “new territory”, or experienced tension, possibly). What did you do? What resources did you have to help you (people, ideas, books, websites, etc)?

3. What resources do you wish you had to help you as you try to improve or change your teaching? Explain.

4. Whom do you consider to have “expert knowledge” in your department? Why, and what is that person knowledgeable in?

5. As you prepared for the “Research Lesson” in May, what resources did you use to help you make sense of the mathematics in the lesson? What resources did you use to help you make decisions about how to teach the lesson?

6. Did participation in the “Research Lesson” in May change your ideas about how you might seek help from others in your department? If so, in what way?

7. Did participation in the Research Lesson change your ideas about how you might seek help from resources outside of your department (including texts, other people, both in the building/district and outside of the district, other sources of information or knowledge that you needed)? If so, in what way?
REFERENCES
REFERENCES


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http://peabody.vanderbilt.edu/teaching_and_learning/


