Session Number: **25**

Abstract Name: **Changes in School Learning Networks from 2006 to 2009**
MSP Project: Milwaukee Mathematics Partnership: Sharing in Leadership for Student Success
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1. Questions(s) or issue(s) for dialogue at Learning Network Conference session:

What changes have been observed in school-based learning networks that may be attributed to the strategies implemented by the funded Math Science Partnership? What evidence exists regarding these changes?

How does Social Network Analysis, as a methodology, help us understand changes in learning networks? How does this methodology contribute to evaluating the impact of the partnership?

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2. Context of the work within the STEM education literature and within your MSP project:

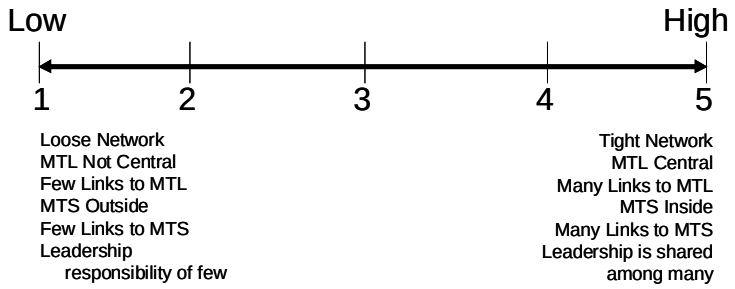
One of the primary goals of the MMP has been to promote distributed leadership for mathematics across the Milwaukee Public Schools. Key strategies were established to promote distributed leadership, including creation of the MTL role in schools and supporting the work of district math teaching specialists. Within schools, MTLs were expected to promote mathematical conversations, provide teacher professional development, and encourage rank and file teaches to get involved in the MMP.

MTLs engage in a variety of different activities. First, they attend monthly professional development sessions. These day long sessions are designed and implemented by district teaching specialists, working in collaboration with IHE faculty. A typical session incorporates information on mathematics content, pedagogy, and leadership development. MTLs are then expected to take this knowledge back to their individual schools and work with individual teachers to enhance their performance. This might be done by modeling lessons, coaching teachers, and through small group meetings. MTLs also lead the development of school-based mathematics action plans whereby school may receive supplemental funding from the MMP for special projects. In addition, MTLs may work on district-wide projects, such as designing classroom based assessments, supporting textbook adoption programs, or creating rubrics for scoring constructed response items on mathematics assessments. Throughout, IHE faculty guide this activity by promoting alignment with national and state standards and ensuring the accuracy and depth of mathematics content knowledge instruction.

All of this activity was designed to promote distributed leadership for mathematics. A distributed leadership continuum was described (Hanssen & Huinker, 2008) to illustrate how schools have progressed as a result of their MMP-related work (see Figure 1 below).

Social Network Analysis (SNA) (Durland & Fredericks, 2005) has been used by the MMP to document the nature of school-based learning communities and to help evaluate the extent to which the MMP is helping to reach its goal of distributed leadership (Hanssen & Walker, 2007; Hanssen & Durland, 2007). Past results have focused on commonalities and characteristics evident in select schools within a given year. This year, we examined changes in 11 schools that were first studied in 2006.

Figure 1. Distributed Leadership Continuum



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3. Claim(s) or hypothesis(es) examined in the work (anticipating that veteran projects will have claims, newer projects will have hypotheses):

Schools exhibited changes in their social networks between 2006 and 2009. First, MTLs became more central figures in their respective school networks. This is a reflection of the maturity of the MTL role and broader recognition by school personnel that the MTL is the leader for mathematics teaching and learning at the school level. Second network density has decreased slightly, which is a result of movement to a released MTL model.

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4. Evaluation and/or research design, data collection and analysis:

SNA data were collected using a pencil-paper survey that was administered to all mathematics teachers and other mathematics education stakeholders (e.g., Learning Team members) in a school. In 2009, a self-administration packet was used to facilitate administration of the SNA survey. Survey respondents were asked to indicate who they communicated with about mathematics, the frequency of that communication, and the extent to which they collaborated with each individual named. Based on past work, respondents were asked to limit their list of individuals to 15 people; the vast majority of respondents indicated fewer than 10 individuals on their surveys.

Data for each school were compiled in two spreadsheets—the first contained ‘matrix’ data which indicated ‘who chose who.’ The second contained demographic data for each unique individual named across all of the surveys submitted by a school. A typical school data set indicated a ratio of approximately 1:2-3 of survey respondents to unique individuals named. This open SNA approach has the added benefit of allowing us to assess the extent to which a school’s mathematics education network extends beyond the school.

Data were analyzed using UCINET software (Borgatti, et. al, 2002). Four descriptive statistics were calculated for each network—two measures of network density, a measure of the perceived importance of the MTL, and a measure of the perceived importance of the MTS assigned to that school.

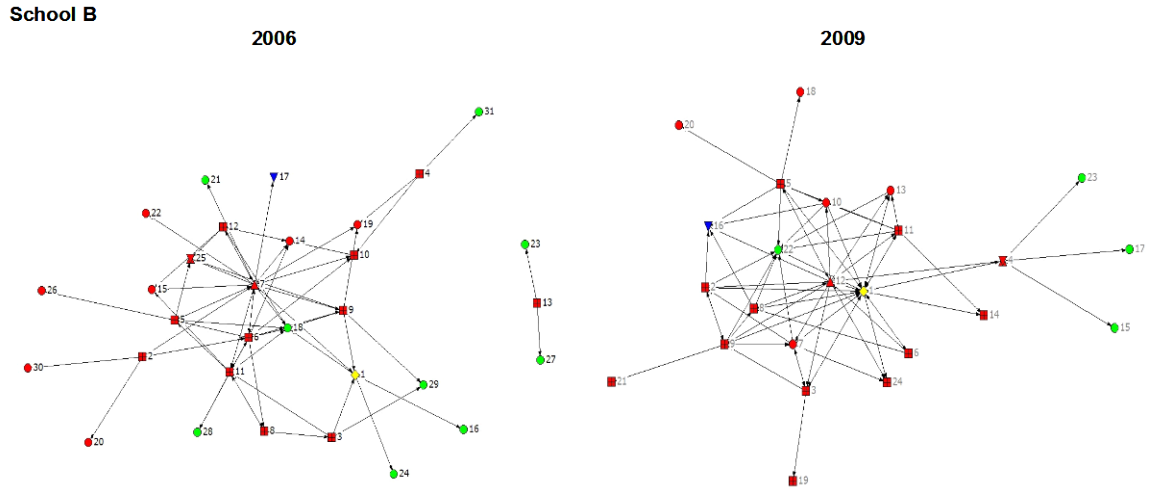
Density is defined as the total number of ties divided by the total number of possible ties in a network and is represented as a percentage. For example, if a network contains three individuals, the total number of possible ties is six, which would occur if everyone in the network named all of the others in the network. If only five ties were articulated by the survey respondents, then the network density would be .83 or 83%. Density was calculated twice—first using just the individuals who work in the subject school and secondly using all the individuals named, which included individuals outside of the school. In interpreting these statistics, the difference between network-wide density and the density within school yields important information about, for example, the degree to which a school extends beyond its walls to improve mathematics education or whether a school takes a more insular approach.

MTL Importance and MTS Importance are evaluated using the Freeman Degree Centrality measure (Freeman, 1979). This metric is an indicator of how important an individual is to the network—a higher number indicates that other individuals named that individual frequently and thus they are perceived as important to the network. Normalized scores are reported so that values across different networks can be compared. Essentially, however, higher numbers indicate greater importance in the network. This measure is commonly referred to as the 'In Degree.'

Sociograms were prepared for each school and compared with the sociogram prepared in 2006. A sociogram provides a graphical depiction of the social network. The key features are nodes (i.e., individuals), and ties (i.e., links between individuals depicted by lines). Figure 2 below displays sociograms for an example school.

Two important trends were evident based on analysis of results from these schools. First, the average density of the in-school network was lower in 2009 than in 2006, though this difference was not statistically significant (p=.24). At the same time, the average MTL Role In-degree measure was substantially higher in 2009 than in 2006. This increase was statistically significant (t=6.81, p=.00). Negligible differences were seen in this small sample of schools on the other measures.

Figure 2. 2006 and 2009 Sociograms for an example school.



These results suggest the possibility of a fundamental shift in how school-based networks function; further this shift may be due to the emergence of the released MTL-model as the dominant approach to math teacher leadership across MPS; even the one school that did not have a released MTL exhibited similar changes from 2006 to 2009.

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5. Key insights (retrospective for veteran projects, prospective for newer projects) that have value for the Learning Network:

Given that partnerships are perhaps the critical aspect of the MSP program, documentation of partnership changes with appropriate methodologies is important. Using SNA, changes in school based networks have been documented and aligned with the key MMP strategy of institutionalizing the math teacher leader. This strategy has been critical for driving the evolution of school-based partnerships.

The introduction of a math teacher leader into a school provided a focal point for mathematics leadership. Over time increased communication among teachers and administrators was observed. In this initial model, MTLs were not released from full-time teaching responsibilities so it was also imperative that MTLs encourage broader involvement from more teachers within their school. The shift to a released MTL model may have triggered changes in communication patterns within a school. The first change can be regarded as positive—the strengthening of the MTL as the focal point for mathematics leadership. The second change, a small decrease on school-wide communication, may or may not be seen as positive. The remaining question is whether the change to a released MTL model has, in some ways, absolved other teachers in a school from responsibility for mathematics leadership. In effect, while strong leadership may exist and even be strengthened by the released MTL model, that leadership might not be described as 'distributed.' Thus a key question remains—which is more important for improving mathematics teaching and learning—strong leadership or strong distributed leadership.

There are several implications of this work for other MSP projects. First, MSPs should consider what methodologies can be used to track the evolution of partnerships, networks, and/or collaborative relationships among their target schools, districts, or institutions. SNA appears to work well with relatively well-defined sets of individuals who are tied to defined organizations. For MSPs with clear target schools or districts, this method would be useful for monitoring changes in those networks. Second, the importance of specific individuals or roles within those networks can be clearly described using SNA. Thus, if an MSP is promoting a teacher leader (or similar) strategy, the evolution of this role can be traced from inception. Similarly, if there is a shift in strategy, this strategic shift can be aligned with observed network changes. Third, MSPs should align their definition of leadership to specific behavioral indicators that can be observed and measured. SNA may be an option for documenting the presence of these indicators and associated changes over time.

References

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