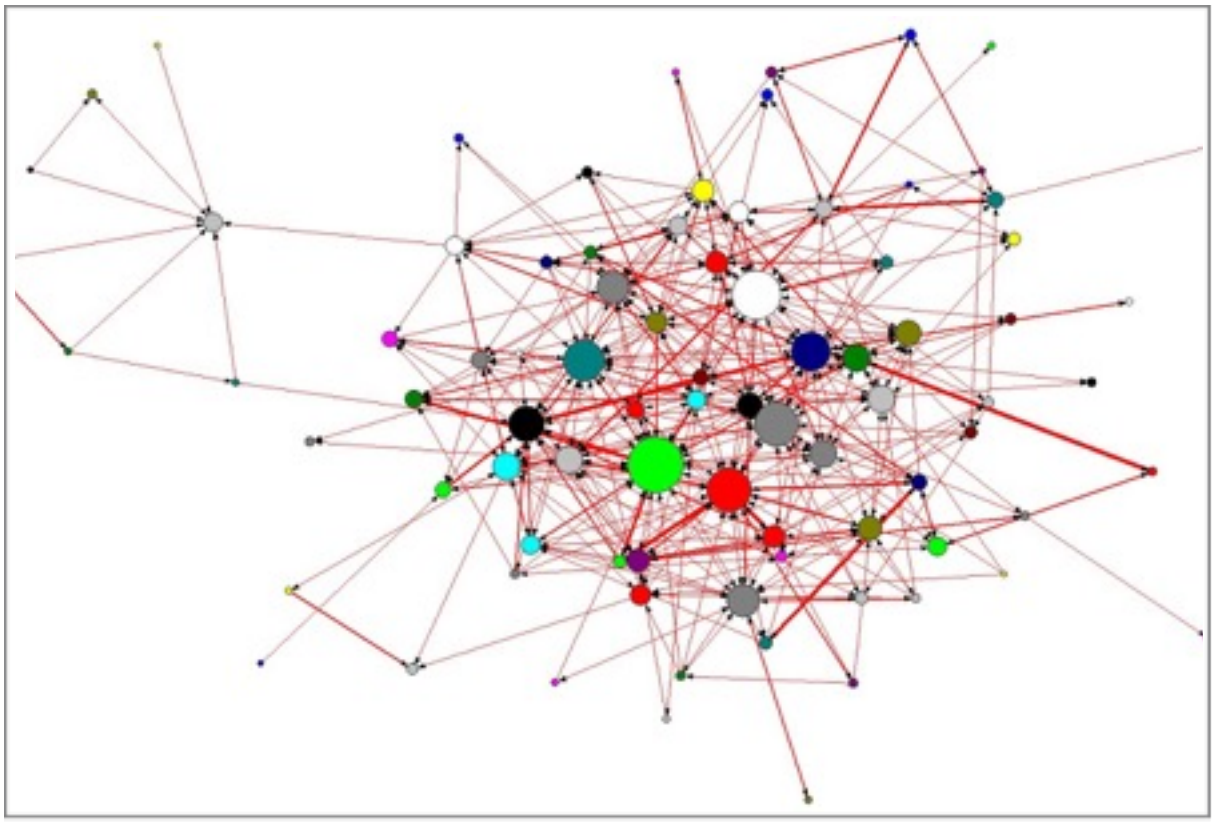
Networks of Schools

Theory, Research and Methodology



Annotated Bibliography & Review

Autumn 2014

Contents

I. Background information on research on networks (how has the field evolved)

II. Defining networks: what are networks, what are relevant dimensions to describe networks, what are different types of networks (network components)

III. Potential effects of networks

IV. Available research methodology to evaluate and monitor networks

V. Miscellaneous

Background information on research on networks

(how has the field evolved)

Introduction

Social networks are the relationships and flows between people, groups and organisations. In contrast to an organisation chart which shows formal relationships of who works where and with whom, social networks indicate the informal relationships of who knows who and who shares information with whom, showing the real networks that operate underneath the surface organisational structure (kstoolkit, retrieved 21 March 2013). Social networks take the perspective of studying individuals as embedded in a network of relations and seek explanations for their behaviour in the structure of these networks, rather than in the individuals alone. Social networks are visualized by the ties between people and the paths that information and knowledge follow in the network. These ties and knowledge transfers make up the structure of the network and are described according to the density, reciprocity and level of centralization of the network (Moolenaar, 2010). Density represents the concentration of relationships in a social network; a dense network has a large proportion of relationships between school staff members. According to Moolenaar (2010, p38), reciprocity captures the extent to which the relationships in the network are mutual. Centralization indicates the central tendency of the network and whether the relationships in the network are evenly dispersed or are centralized around one (or a few) central people (e.g. Teach First teachers).

A network is defined by Hadfield et al (2006, p.5; cited by Muijs et al, 2010[1], 5) as: ‘‘groups or systems of interconnected people and organisations (including schools) whose aims and purposes include the improvement of learning and aspects of well-being known to affect learning’’. Most definitions emphasize the cooperation of at least three organisations, although Muijs et al (2010) also con-

[1] Muijs, Daniel, West, Mel and Ainscow, Mel (2010) Why network? theoretical perspectives on networking and collaboration between schools. School Effectiveness and School Improvement, 21, (1), 5-26. (doi: 10.1080/09243450903569692).

sider the cooperation of two organisations as a network. Muijs et al (2010) explain how traditionally, in sociopsychological terms, a network has been defined as a set of actors (individuals or organisations such as schools) connected by a set of ties, which can be of a more or less formal nature.

Social capital, the patterns of interactions among educators, may be at least as important as an individual's human capital as the focus of improvement for school reform (Brass, 2011[2]; Leana, 2011[3]; Pil & Leana, 2009[4]). For example, a principal's centrality in advice-seeking networks fosters network solidity and student achievement (Daly, 2012[5]; Friedkin & Slater, 1994[6]). This is not to underplay the importance of improving the competence of teachers through training, professional development, and other ways of increasing a teacher's human capital. However, policy makers and practitioners may be underplaying the role and importance of the interplay between human capital and social capital and their role in the development of intellectual capital. Paying attention to and supporting the social capital found in networks can result in performance benefits. Additionally, an actor's embeddedness, represented by his social capital, can lead to increased job satisfaction and performance (Cross, Borgatti, & Parker, 2002[7]). A framework that extends the focus of human capital to include social capital is critical to organizational improvement.

Emerging research is helping to answer questions about the role of social capital and its place in organizational change in schools. Daly et al. (2010[8]) conducted research in an underperforming school district to gain insights into how social

---

[2] Brass, D.J. (2011). A social network perspective on industrial/organizational psychology. In S. W.J. Kozlowski (Ed.),The Oxford handbook of organizational psychology. New York: Oxford University Press.

[3] Leana, C. R. (2011). The missing link in school reform. Stanford Social Innovation Review, 29-35

[4] Pil, F. K., & Leana, C. (2009). Applying organizational research to public school reform: The effects of teacher human and social capital on student achievement. Academy of Management Journal, 52(6), 1101-1124.

[5] Daly, A. J. (2012). Data, dyads, and dynamics: Exploring data use and social networks in educational improvement. Teachers College Record, 114(11), 1-21.

[6] Friedkin, N. E., & Slater, M. R. (1994). School leadership and performance: A social network approach. Sociology of Education, 67(2), 139-157.

[7] Cross, R., Borgatti, S. P., & Parker, A. (2002). Making invisible work visible: Using social network analysis to support strategic collaboration. California Management Review, 83(3), 124-132.

[8] Daly, A. J., Moolenaar, N., Bolivar, J., & Burke, P. (2010). Relationships in reform: The role of teachers' social networks. Journal of Educational Administration, 48(3), 20-49.

relationships may influence direction, speed, and depth of organizational change. Through the analysis of social network data and interviews, researchers presented four themes from the data: (a) reform is initially diffused through principals, (b) reform happens at the grade-level unit and there is significant variability among grade levels, (c) instrumental and expressive interactions are associated with collective action, and (d) instrumental and expressive interactions are associated with efficacy and satisfaction.

Other research suggests that teachers gain craft knowledge in content, pedagogy, and knowledge (human capital) about the student population as they teach at a school. Finally, the research suggests that the interactive relationship between human and social capital is a predictor of student achievement (Daly et al., 2011, p. 28[9]).

Network-Centric Research in Education

Early Years

Schools have historically been part of networks even if the term network has not always been used. Consortiums of rural schools, urban schools, vocational schools, religious schools, and boarding schools have always been present in the broad fabric of education. Given this context, it is surprising how little research focusing specifically on networks has been conducted in education. Despite a body of research in sociology, business, political science, and computer science, it is difficult to find a single study conducted before 1970 that focuses primarily on networks or network-centric activity in education[10]. Parker (1977[11]) de-

---

[9] Daly, A. J., Der Martirosian, C., & Chrispeels, J., (2011). The significance of teacher knowledge within teacher social networks. Paper presented at the 24th Annual International Congress for Effective Schools, Cyprus.

[10] This gap in network research between education and other disciplines eventually came to the attention of the School Capacity for Problem Solving Group (SCPSG), a standing committee of the US National Institute of Education (NIE). In 1977, the SCPSG asked leading social scientists, like John Goodlad, Donald Schon, Dan Lortie en Per Dalin, with an interest in networks to share how network research might contribute to new models of educational reform. The manuscripts written for the project were never published or widely distributed. However, the group's work was referenced regularly in network research published in the 1980s and early 1990s.

[11] Parker, L. A. (1977). Networks for innovation and problem solving and their use for improving education: A comparative overview. Unpublished manuscript, National Institute of Education, Washington, D.C.

scribes a network lifecycle that involves distinct stages ranging from initial meetings of isolated innovators and problem solvers to the eventual dissipation of the "network spirit." Looking at a network of eighteen elementary schools in eighteen different California school districts, Goodlad (1977[12]) concluded that networks need to focus on new kinds of processes and relationships and avoid a-contextual initiatives such as curricula, patterns of school organization or approaches to teaching. This insight is particularly important given the unfortunate tendency by schools to implement centrally developed strategies under the banner of a *network* — doing so reflects at best a misunderstanding of networks and at worst a cynical attempt to coopt a network approach that, according to Goodlad, is doomed to fail.

Schon (1977[13]) notes that the informal nature of networks are well suited to educational settings because schools and school districts are often less rigid than other organizations. Schon cautions, however, that networks are uncertain instruments of reform because they depend on people willing and able to adopt networked roles and networks work on timetables that do not always correspond to the needs of a school or school district. Like Schon, Lortie (1977[14]) sees the benefit of informal network's limited degree of intentionality—they tend to reflect the desires of the people who will carry out the reform instead of a management team that might not be as invested. However, he identifies very practical concerns with using informal networks as a reform strategy due to the logistical problems of bringing highly segmented personnel together towards common action.

Dalin (1977[15]) agrees that natural changes – those not systematically planned by management outside of schools and school districts – offers an appealing reform strategy for teachers and those rarely consulted in educational reform. However, the challenges of integrating different levels of school employees in a network

---

[12] Goodlad, J. I. (1977). Networking and educational improvement: Reflections on a strategy. Unpublished manuscript, National Institute of Education, Washington, D.C.

[13] Schon, D. A. (1977). Network-related intervention. Unpublished manuscript, National Institute of Education, Washington, D.C.

[14] Lortie, D. C. (1977). Networks and organizational rationality in American schools. Unpublished manuscript, National Institute of Education, Washington, D.C.

[15] Dalin, P. (1977). Networks for educational change. Unpublished manuscript, National Institute of Education, Washington, D.C.

reform strategy make Dalin dismissive of networks as a reform model. Dalin also introduces the complication that the increased communication of networks can reinforce certain barriers to change as easily as they can facilitate the acceptance of new ideas.

Parker (1977[16]), Goodlad (1977) and Rosenbaum (1977[17]) extols the potential of networks to avoid efficiency problems endemic in bureaucracies. In particular, he finds that networks can enable members of the community to gain access to the resources of others, lessen the likelihood of duplication of effort and waste energy among members, and allow less experienced participants to draw upon the insights of more experienced ones. However, Rosenbaum also warns sustained and sincere federal commitment is crucial if networks are to have enough influence to shape the direction of hierarchical organizations like schools. Reviewing case studies of government-mandated network-centric reforms, Peterson (1977[18]) concludes that government-initiated network reform models should begin where community interests have already begun to express themselves, have limited objectives. The most useful networking experiments should build systems of communication, and use non-monetary incentives whenever possible. Although generally pessimistic that networks offer a viable change strategy for schools, Peterson believes that government intervention must be modest in order to encourage as much network autonomy as possible.

Drawing conclusions, Miles (1977[19]) notes that people from funding agencies, state departments, universities, and schools alike believe that building and using networks can support educational improvement. The author notes that "social networks may be formally instituted or informally emergent; they may be trans-organizational or internal to existing organizations; they may be fully known in visible to their members, or so dispersed that their members do not fully know or understand the network of which they are part; and they may have no center,

---

[16] Parker, L. A. (1977). Networks for innovation and problem solving and their use for improving education: A comparative overview. Unpublished manuscript, National Institute of Education, Washington, D.C.

[17] Rosenbaum, A. (1977). Social networks as political resource: Some insights drawn from the communit,y organizational, and community action experiences. Unpublished manuscript, National Institute of Education, Washington, D.C.

[18] Peterson, P. E. (1977). Schools, groups and networks: A political perspective. Unpublished manuscript, National Institute of Education, Washington, D.C.

[19] Miles, M. B. (1977). On networking. Manuscript, National Institute of Education, Washington, D.C.

or one center, or more." One helpful organizing principle suggested by Miles is to look at networks on macro and microsystem levels. The key units in a macro system include schools, districts, regional entities, state departments of education, universities, and federal agencies. Looking at the microsystems includes considering goals, technical capability, coordination, and the boundary management of networks (Miles, 1977).

Ann Lieberman (2000[20]) was the most prolific researcher of educational networks during those days, focusing on networks that functioned outside of the mainstream educational establishment to provide support and professional development for teachers. A few of these networks had sufficient funding to offer summer retreats that trained thousands of teachers from across the US. Many of these teachers identified so strongly with the program that they formed a national network before the Internet made it is easy to do so. Looking at these pre-internet networks, Lieberman concludes that successful networks encourage a sense of identity, sustain teachers' interest and commitment, encourage communication among members, and most importantly, promote change in ways other types of reform do not. However, adopting a network organization is no guarantee against the following problems:

- **Quality** – Network initiatives are not always evaluated and improved.
- ***Application*** –The ideas and perspectives created within a network cannot always make it into schools to create meaningful change.
- ***Stability*** – Funding, membership turnover, and sustained leadership all lead to potential instability.
- ***Overextension*** – The more popular the work, the greater the demand on limited resources and the lower the amount of time, money and energy the network has for understanding what is being learned how to apply it.
- ***Ownership*** – The independence of many networks from districts or other "official" structures is a source of strength. But as networks develop, it can become less clear who controls the agenda. Since the power of these networks lies in their flexibility, the agendas are in a constant state of refinement, rather than fixed in time or place.

---

[20] Lieberman, A. (2000). Networks as learning communities: Shaping the future of teacher development. Journal of Teacher Education, 51, 221-227. doi: 10.1177/0022487100051003010

- ***Expanding objectives*** – Political considerations, negotiation, policymaking, and conflict are part of what networks do to encourage organizational change.
- ***Leadership*** – Networks walk a fine line between the explicit assignment of organizational responsibility (managing the network, orchestrating its activities, and promoting the involvement of teachers) and the temptation to create hierarchical structures. Without leadership to understand these challenges, networks can become like the bureaucracies they are trying to change.
- ***Evaluation*** – Models of accountability or evaluation need to reflect and support the nature and power of networks.
- ***Goals*** – The success of an educational network depends on members' perception that it serves their own goals -- not the goals specified by some outside agent (Lieberman & McLaughlin, 1992[21]).

The most important single variable for network success is the context in which educational change is pursued. As a result, the authors suggest that networks should be viewed through an occupational rather than an organizational lens. Switching to an occupational lens moves the policy focus from a concentration on what works, framed solely in terms of student outcomes, to an examination of the meaning of teaching for those who do it (Lieberman & McLaughlin, 1992).

Wohlstetter et al. (2003[22]) see the experimental use of networks in education as borrowed from other public policy arenas like community development and health. "Applied to schools, the idea of networks suggests that schools working together in a collaborative effort will be more effective at enhancing organizational capacity and improving student learning than individual schools working on their own" (Wohlstetter, Malloy, Chau, & Polhemus, 2003). McDonald and Klein (2003[23]) use the phrase "design tensions" to describe the challenges of network design for teacher involvement. They also conclude that networks

---

[21] Lieberman, A., & McLaughlin, M. W. (1992). Networks for educational change: Powerful and problematic. Phi Delta Kappan, 673-677.

[22] Wohlstetter, P., Malloy, C. L., Chau, D., & Polhemus, J. L. (2003). Improving schools through networks: A new approach to urban school reform. Educational Policy, 17(4), 399-430.

[23] McDonald, J. P., & Klein, E. J. (2003). Networking for teacher learning: Toward a theory of effective design. Teachers College Record, 105(8), 1606-1621.

function differently in education than they do in other governmental, non-profit, and development sectors (McDonald & Klein, 2003).

Recent Research

Formation and roles in social networks

Casciaro and Lobo (2005[24]) provided insight into the formation of social networks in organizations. People are hired into organizations based on their unique skills and abilities to perform the necessary functions and activities of the organization. While each person has his or her own area of expertise, everyone must work together. The very fact that people are unique and have different talents may lead to compartmentalization of knowledge and activity. The researchers posit that upper management must ensure that everyone is working together in the organization in order to transfer information and to get tasks accomplished.

People determine with whom they prefer to work based on several factors. People tend to want to work with people who are similar to them. They may share the same background, culture, beliefs, interests and personal styles. People also have a tendency to want to work with people who appear to like them. When a person shows a personal interest in someone else, there is a greater chance that these people will want to work together. Another factor influencing how people choose their work partners is physical attractiveness. People tend to want to work with others based on their looks. Borgatti and Cross (2003[25]) conducted research suggesting that critical dimensions for relationships include knowledge (knowing what someone knows), access (gaining timely access to that person), engagement (creating viable knowledge through cognitive engagement), and safety (learning from a safe environment).

---

[24] Casciaro, T., & Lobo, M. S. (2005). Competent jerks, lovable fools, and the formation of social networks. Harvard Business Review, 83(6), 92-99.

[25] Borgatti, S. P., & Cross, R. (2003). A relational view of information seeking and learning in social networks. Management Science, 49(4), 432-445.

The work of Borgatti and Cross (2003) and Casciaro and Lobo (2005[26]) provided a framework for understanding how and why social networks form. This research complements research by Fleming and Juda (2004[27]) who suggested that key players or "gatekeepers" in social networks have the ability to "catalyze" aggregate small networks into larger ones. These large networks are characterized by their innovativeness and creativity. One such network, holding patent authorship throughout the United States, was studied and inventor networks were measured. Groups of diverse inventors that were once isolated are now connected. The researchers identified an important negative effect from inventor networks. Highly networked companies can suffer from information leaks to competitors. Not participating in these networks could result in stagnation, less creativity and less innovation. Upper managers can respond to this threat by nurturing highly connected gatekeepers. These gatekeepers are the holders of the technical knowledge and they know how to assess the competitive risks involved with sharing information. Fleming and Juda (2004) recommended, "To maximize the benefit and minimize the risk of inventor networking, encourage your gatekeepers to aggressively build connections outside of their specific disciplines and industries" (p. 22).

Anderson et al. (2010[28]), found results similar to those of Fleming and Juda (2004) that school principals in high data use schools hold key positions as enablers of data use. In this role, which is similar to that of the gatekeeper, principals afford the resources of tools, time, and expertise. They also hold teachers accountable for the use of data.

School board policy and social networks

School board policy is shown to have an influence on teachers' social networks. Policy can influence the structure of the networks, how teachers access expertise, and the depth of the interactions among teachers (Coburn & Russell,

---

[26] Casciaro, T., & Lobo, M. S. (2005). Competent jerks, lovable fools, and the formation of social networks. Harvard Business Review, 83(6), 92-99.

[27] Fleming, L., & Juda, A. (2004). A network of intervention. Harvard Business Review, 82(4), 22.

[28] Anderson, S., Leithwood, K., & Strauss, T. (2010). Leading data use in schools: Organizational conditions and practices at the school and district levels. Leadership and Policy in Schools, 9(3), 292-327.

2008[29]). School board policy can influence teachers' social networks, thereby creating more opportunities for teachers to meet and work collaboratively. These opportunities to work collaboratively can have limited impact if there are multiple priorities vying for the teachers' time and attention. In coaching relationships, it is crucial that the coaches have access to rigorous professional development in order for them to engage in conversations with teachers that are of high quality which will lead to improvements in instruction and pedagogy. School boards can craft "routines of interaction" through school coaches that will allow for more than just the information to flow between social networks. These "routines of interaction have the potential to either interrupt or reinforce modal patterns of teacher interaction" (Coburn & Russell, 2008, p. 225).

Teachers' social networks were found to invariably go beyond the confines of grade-level associations to others within and outside of the school. Research also suggests that as tasks that originate from the school board office become more distant from work with students, teachers tend to become more isolated and communication within networks declines (Bakkenes, et al., 1999[30]).

The social networks that develop between and among central office administrators and site principals may be distinct based on their purpose (Hite et al., 2007[31]). Different types of networks are used for different purposes. Innovation networks, for example, are used by actors who think collaboratively, share similar beliefs regarding teaching and learning, and who are successful at gaining support for their ideas. Resource networks exchange physical, financial, and information advice. Social/emotional networks exchange social and emotional support, and finally, partnership networks support formal district partnerships. Conceptualizing these and other types of networks that exist between principals and central office administrators provides greater understanding of how relationships develop and sustain themselves over time.

---

[29] Coburn, C. E., & Russell, J. L. (2008). District policy and teachers' social networks. Educational Evaluation and Policy Analysis, 30(3), 203-235.

[30] Bakkenes, I., De Brabander, C., & Imants, J. (1999). Teacher isolation and communication network analysis in primary schools. Educational Administration Quarterly, 35(2), 166-202.

[31] Hite, J. M., Williams, E. J., & Baugh, S. C. (2005). Multiple networks of public school administrators: An analysis of network content and structure. International Journal of Leadership in Education, 8(2), 91-122.

Social networks and structure. Balkundi and Kilduff (2005[32]) explored network theory that "emphasizes networks as both cognitive structures in the minds of organizational members and opportunity structures that facilitate and constrain action" (p. 942). Opportunity structure refers to the concept that opportunity, the chance to gain certain rewards or goals, is shaped by the way an institution is structured. Social cognition and social structure approaches are connected to form a network approach to leadership. Brass (1981[33]) also focused on the structural components of organizations. His study investigated job characteristics such as skill variety, task identity, task significance and task support as mediating variables in the relationship between the organization's structure and the attitudes and behaviors of individual employees. His findings suggest that the position an employee holds in the workflow needs to be considered and that workflows as well as jobs may need to be redesigned to accomplish goals.

Four principles are key concepts and ideas common to all research on organizational network structures (Balkundi & Kilduff, 2005). The relations between actors, the first core principle, refers to understanding the importance of the interactions between actors, as opposed to emphasizing the attributes of actors. Embeddedness can be conceived as the preference that actors have to interact with others within the community as opposed to those outside the community. Social capital is the spirit, trust, and interdependence among actors with the system. Finally, structural patterning is the network of connections and the degree to which actors can reach each other through network connections (p. 943). An effective leader is viewed as one who is not only knowledgeable of the social relationship in the organization, but one who can manage these types of relationships. The work of the leader is accomplished through cognitions in the mind of the leader, the organizational network, and the inter-organizational network.

The framework provided in social network theory suggests that the existing structure of social relationships has profound influences on the implementation

---

[32] Balkundi, P., & Kilduff, M. (2005). The ties that lead: A social network approach to leadership. The Leadership Quarterly, 16, 941-961.

[33] Brass, D. J. (1981). Structural relationships, job characteristics, and worker satisfaction and performance. Administrative Science Quarterly, 26, 331-348.

of any organizational change (Brass et al., 2004[34]). Also, leaders benefit greatly from social networks by affording them with support, insight, feedback and resources (Ibarra & Hunter, 2007[35]). Furthermore, social networks can serve to support or constrain reform efforts (Daly et al., 2010). Social networking is a phenomenon that is not unique to schools only. It is important to note that researchers have conducted studies in a variety of settings including business, science, and health industries.

Quality of relations between boards and schools

A sense of trust between members of social networks appears to be an important factor that supports social capital. When levels of trust are high, reciprocal ties are more numerous and change or reform is more likely to occur (Moolenaar, Daly, & Sleegers, 2010[36]). Three constructs of trust — respect, risk, and competence — have high predictive relationships with both adaptive and technical leadership (Daly & Chrispeels, 2008[37]). Respect can be defined as the inclusion of others, risk is the willingness to be vulnerable, and the maintenance of high expectations is competence. Understanding and fostering trust between district administrators and school principals are key components in the development social capital.

Daly and Finnigan (2010[38]) analyzed the levels of trust that exist between district leaders and site leaders in social networks. Insights into supports and constraints related to school improvement resulted from this analysis. Organizational improvement efforts are viewed as socially constructed. Overall, the data suggest low levels of trust within the district studied. Central office and principals tended to have different perceptions of the level of trust in overall scales. Findings suggest that the quality of relations, as measured by trust, is a key el-

---

[34] Brass, D. J., Galaskiewicz, J., Greve, H. R., & Tsai, W. (2004). Taking stock of networks and organizations: A multilevel perspective. Academy of Management Science, 47(6), 795-817.

[35] Ibarra, H., & Hunter, M. (2007). How leaders create and use networks. Harvard Business Review, 58(1), 40-47.

[36] Moolenaar, N., Daly, A. J., & Sleegers, P. J. (2011). Ties with potential: Social network structure and innovation in Dutch schools. Teachers College Record, 113(9), 1983-2017.

[37] Daly, A. J., & Chrispeels, J. (2008). A question of trust: Predictive conditions for adaptive and technical leadership in educational contexts. Leadership and Policy in Schools, 7(1), 30-63.

[38] Daly, A.J., & Finnigan, K. (2010). Understanding network structure to understand change strategy. Journal of Educational Change, 111, 111-138.

ement in the development and ongoing success and health of reciprocal ties that result in the development of exchanges about best practices that lead to school improvement. Honig (2008[39]) reinforced the importance of trust as it relates to brokers or boundary spanners. Brokers, or boundary spanners, function in the space between communities of practice. They assist in bridging to new ideas and shielding from unproductive ones. They can assist in strengthening instructional and pedagogical practices. In order for brokers to be accepted and to appear legitimate, they must gain trust and be viewed as a trusted resource. A broker can be anyone who fills the role of bridging the gaps between communities of practice.

Honig and Coburn (2008[40]) did a comprehensive review of the research literature on evidence use in district offices. A theme found in the literature focused on the quality of relations between and among district office administrators and principals, as measured by trust. The social capital with individual district office administrators, their formal and informal ties with others, combined with their level of trust, and shared norms affect evidence use. In other words, when a sense of trust existed, district office administrators were more able to access various forms of evidence internally within the district office. When site administrators trusted that district office administrators were collecting student data to support them rather than to penalize them, higher levels of collaboration were evident. Finally, communities helped the school district by giving evidence in the form of feedback when levels of trust were high. Findings suggest that it is important not only to pay attention to the technical aspects of school improvement, but that relational linkages such as trust, are significant as well (Daly & Finnigan, 2011).

Clearly, central office administrators play a critical role in school reform efforts. By providing principals with a clear focus, aligning the technical core of teaching, and developing trusting relationships, schools have improved their instructional programs and student achievement has been accelerated. Central office administrators can communicate information and facilitate the creation of ideas

---

[39] Honig, M. I. (2008). District central offices as learning organizations: How sociocultural and organizational learning theories elaborate district central office administrators' participation in teaching and learning improvement efforts. American Journal of Education, 114, 627-664.

[40] Honig, M. I., & Coburn, C. (2008). Evidence-based decision making in school district central offices: Toward a policy and research agenda. Educational Policy, 22, 578-608.

through a pattern of relational ties. These ties form the building blocks of social networks.

Implications of research for educational reform

Network research in the areas of business, government, and international development help explain a lot about the way networks and network-centric activity can solve complex problems – but two important questions remain. First, how much of this research is applicable to educational settings in general and reform specifically? Second, how can we know whether networks are any more successful than traditional organizational approaches to reform?

The answer to the first question is complicated by the lack of network research conducted specifically in educational settings. Despite the early contributions in the 1970s about the potential for network activity to influence reform, there has been very little education-specific research on network reform models. There also does not appear to be the same level of awareness of network-centric activity among educators or educational researchers as exists in areas like business, government and international development organizations. As a result, there are comparatively few (if any) examples of network-centric reforms used to encourage systemic reform as there are in business, government, or in international development.

The lack of awareness of networks and an ongoing dearth of research about networks in education means that educators and educational policy-makers are less likely to take advantage of network principles at the very time that network-centric activity has entered the public consciousness and is being widely adopted across sectors of our society. Specifically, educators are not building the experience and comfort level or research base to address the following challenges associated with networks.

• The complexity of networks requires a shift in perspective from managing individual people to managing the relationships and interdependence among network members.
• The diversity of networks means that networks are contextual and can vary dramatically depending on their purpose, size, decision-making, and gover-

nance. It takes time to understand how a network operates and to maximize the members' capabilities.
• As voluntary organizations, networks depend on the members' willingness to contribute their time and knowledge. Networks only thrive when they represent the interests of their members or add value for the members.
• Networks have shorter life cycles. Unlike traditional organizations that are usually formed for a specific reason or goal, Networks form quickly, but also can disband quickly when the network reaches its goal.

One of the most challenging questions to answer regarding network-centric reforms involves their monitoring and evaluation – how is it possible to know whether networks are responsible for change. This question is made even more challenging by the fact that the monitoring and evaluation of networks and network-centric activity is perhaps the least studied or understood aspects of network phenomena. Most early research about networks was descriptive and anecdotal — it is only recently that researchers have begun developing approaches that are specifically designed for the monitoring and evaluation of networks.

Defining networks: what are networks, what are relevant dimensions to describe networks, what are different types of networks

(network components)

Networks Components

Networks tend to emerge in response to complex problems and their organizational features are context specific. Networks of a few dozen members working on a single issue will be organized differently than an advocacy organization like a teacher union with a membership of nearly two thousand people. Different authors describe different features and characteristics of networks and network evaluation needs to describe the features that a network connected to schools must possess in order to encourage reform.

Cross et al. (2005[41]) described three types of networks and how they are best matched for the nature of the work within the organization. Customized Response Networks are best implemented in situations where problems and solutions are ambiguous. Problems are framed and solved quickly in innovative ways. Modular Responses are associated with teams that must use a sequence of components that have not yet been defined in order to solve a known problem and solution. An example of a team that would use a modular response is a surgical team. A Routine Response approach is used in teams where the work is standardized. Well-run call centers such as the call center at Sallie Mae provide a good example of a Routine Response Network (Cross et al., 2005). These three key findings suggest that it is possible to support the conditions related to social capital that may lead to greater productivity and innovation.

[41] Cross, R., Liedtka, J., & Weiss, L. (2005). A practical guide to social networks. Harvard Business Review, 83(3), 124-132.

Muijs et al (2010) describe networks in education according the following dimensions:

- ***Goals and activities***: network goals as they currently appear to exist in educational practice can be broadly defined as being about school improvement, broadening opportunities (including networking with non-school agencies such as social services or business) and resource sharing.
- ***Timescale***: school networks can be distinguished in terms of the timescale of activities undertaken (e.g. short-term/long-term). Some collaborative arrangements can be intended to be more or less permanent and aimed at fundamental change, as is the case in the ‘‘hard’’ Federations, which are in many ways similar to merger arrangements in the private sector, while others can be very time delimited, such as collaborations around a specific bid or initiative.
- ***Voluntarism or coercion***: the extent to which collaboration has been entered into voluntarily or, for at least one partner, under some form of coercion. At one theoretical end of this continuum, one could find completely voluntary arrangements, whereby two or more schools form a network without any form of incentive. At the other end of the continuum, we find networks in which two or more schools have been compelled to collaborate with one another by the government or LEA, for example, with one school charged with improving the other. Compulsion may, in some cases, be necessary to lead schools to improve and has the advantage of greater control and opportunities for integration. It has clear disadvantages in terms of a likely reluctance of some members of staff in the school to fully engage in the network and in the lack of trust that may result from this.
- ***Power relations***: An important dimension linked to the extent of coercion, but not equal to it, is the extent to which relationships between networks are based on equality or on domination by one or more network partners. In theory, relations based on voluntarism should not be dominated by any actor, with partners working together to solve solutions on an equal basis (though issues of personal power, unequal status between partners, or even unequal leadership capacities may modify this considerably), while coercive relations may be less so (although one can imagine coerced equal relationships, this is not a likely pattern). Unequal relationships will frequently occur where a ‘‘strong’’ school is paired with one or more ‘‘weaker’’ schools to help these improve. Incentives to collaborate appear essential within a competitive cul-

ture that can otherwise make this problematic (Ainscow et al., 2005). Where collaboration is voluntary, there is evidence that it is those organisations more similar in status that are more likely to collaborate, though this tends to come from research in business rather than educational organisations.

- ***Network density***: Networks can differ substantially with regards to their density. One way in which this can manifest itself is in the differential involvement of different groups in the process. As such, collaboration within the network can be largely a matter of heads and senior management, with little involvement (and in some cases little knowledge) of other staff groups. The question of who is involved is also linked to that of similarity of those involved in network activities. In this respect, there is evidence both that individuals with similar attitudes are more likely to successfully interact and that those individuals occupying similar organisational positions in different organisations are more likely to share similar attitudes, suggesting that working groups are best composed of staff at similar levels in the organisational hierarchy. There may also be an element of redundancy in having too many contacts, and an element of confusion may occur as a result (Nooteboom, 2004). Some commentators, however, have described redundancy as a necessary correlate of effective networking, as the complexity thereof could otherwise lead to the possibility of breakages in the network(s).
- ***External involvement***: An important dimension of educational networks is the extent to which external organisations or partners are involved with the network. The extent of involvement of these external bodies can vary considerably, from a purely brokering role at the start of the relationship to being an integral part of the relationship, as is the case for partnerships between child service agencies and schools. In some cases, the external partner can even be the main driving force behind the network, as is the case with some school reform programmes.
- ***Geographical spread***: cross-local, regional, and even international networks may occur as technological advances make this type of networking ever easier.
- ***Density of schools***: Networks also differ in terms of the number of schools involved. Interestingly, a lot of the theory of networks seems to refer to dyadic relationships, even though these are by no means the most prevalent in practice (Nooteboom, 2004). It is clear that networks can differ substantially in size and can also expand and contract over time. In practice, the

smallest networks obviously consist of 2 schools, while the largest networks we are aware of contain no more than 15 schools, though larger networks are theoretically possible. An intermediate network would then consist of between 5 and 10 schools.

Moolenaar (2010) and Daly et al (2010) found that networks in one school and across schools also differ according to the *content and purpose* of knowledge exchange. Moolenaar (2010) identified seven different social networks around discussing work, collaborating, asking for advice, personal guidance, spending breaks, contact outside of work and friendship. The first three networks (asking advice, collaboration and discussing work) showed great similarity, as well as the last three networks, indicating a difference between instrumental social relationships aimed at fulfilling organizational goals, and expressive social relationships that are not directly aimed at work.

Most network evaluation instruments organize discrete network elements into three broad categories: 1) network vibrancy, 2) network connectivity, and 3) network effects. *Network vibrancy* looks beyond the more technical issues about network connections to focus on characteristics like trust, structure and governance. *Network connectivity* looks at the nature of the relationships in a network as well as the reach of the network. *Network effects* focus on the networks outcomes and impact.

Network Vibrancy

This is the broadest and most subjective area of network evaluation as researchers identify the essential characteristics that make networks attractive to new members, successful, and sustainable. Some characteristics of a network's vibrancy relate to members' experience as part of the network. Madeline Church c.s. (2002[42]) concludes that trust among members is essential. Successful networks have members who share core values and a shared set of operating norms governed by explicit written organizational principles.

Essential questions involving structure include how a network is organized and how decisions are made. The shape of the network influences decision- mak-

[42] Church, M. M. Bitel, K. Armstrong, P. Fernando, H. Gould, S. Joss, M. Marwaha-Diedrich, A. L. de la Torre and C. Vouhé. 2002. *Participation, Relationships and Dynamic Change: New Thinking on Evaluating the Work of International Networks.* Working Paper No. 121. Development Planning Unit, University College London. http://www.ucl.ac.uk/dpu/publications/working%20papers%20pdf/WP121.pdf

ing–specifically whether the majority of activity takes place among a small number of network members or whether activity is evenly distributed across the network. Activity can also be evaluated through a lens of ownership: are network members working in the network or for the network? (IDRC, 2002[43]). Since people move in and out of networks much more easily than traditional organizations, which put up barriers to joining in the form of dues structures, another form of evaluation involves looking at membership. According to Church, whether members stay in a network or not are directly related to the degree in which the network remains focused on the issues important to the membership.

Additional benefits to participating in and affiliating with a network include how much the network contributes to members' professional growth and development. In most cases, the development will not be formal or recognized, but instead will be a subjective judgment made by each member. Additional considerations in the evaluation of network vibrancy include the performance of the network when compared to similar networks (Church, 2002), the diversity of the network, and whether the network offers a unique benefit to members.

The vibrancy of a network also depends on the network's ability to manage change. Miller & Drake (2001) look at cohesion and the resilience of networks to withstand membership turnover, particularly the departure of network leaders. The most resilient networks have redundancy and multiplicity in order protect against network failure when a leader leaves the network (Provan and Milward, 2001[44]). Mitchell and Sortell (2000) focus on the alignment of network's activities with the composition of the network's organizations and members. The strongest networks have formal rules for conflict resolution and create organizational structures that match the needs of its membership. Several re-

[43] International Institute for Sustainable Development (IISD). (n.d.). Retrieved from http://www.iisd.org/

[44] Provan, K. and B. Milward (2001) 'Do Networks Really Work? A Framework for Evaluating Public-Sector Organizational Networks', Public Administration Review 61(4): 414-23

searchers have concluded that network participation is highest when the network develops rapidly (Wilson-Grau, 2006[45]; Chapman and Hadfield, 2010[46]).

Unlike traditional organizations established to maintain the status quo or resist change, networks are often established to create change: networks that are unsuccessful bringing about change risk losing the energy and enthusiasm of its members. Since most networks have few permanent staff, the loss of even one key staff or member can cripple a network far more quickly than it would a traditional organization.

Perhaps the most challenging factor for many networks is whether it has the resources to operate effectively. Although networks are typically far less expensive to operate than traditional organizations, they require access to and experience with technology that might be obstacles for the development of networks in some places. Evaluating whether a network has adequate resources is a challenge since it is such a new organizational form that there are no time-tested parameters for the financial stability of a network.

These discrete characteristics of network vibrancy will likely be included in any comprehensive evaluation instrument of networks, but they do not describe the tools that researchers have used to gather data about the characteristics. As previously noted, researchers investigating networks have few established instruments with which to use. With the exception of social network analysis (SNA), which is used primarily for social networks, researchers have developed their own instruments to study other discrete network features. Nearly all network evaluation tools were developed by researchers investigating international development networks.

In *Channels of Participation*, developed by Church et al (2002), concentric circles are used to represent categories of participation. The outer ring represents the lowest level of participation, with inner rings representing increasing levels

---

[45] Wilson-Grau, R. (2006, December 14). Complexity and evaluation in international networks. In MDF's Seminar 'M&E on the Cutting Edge' Retrieved February 14, 2014, from www.informaworld.com/index/K741610252709H54.pdf

[46] Chapman, C., & Hadfield, M. (2010). Supporting the middle tier to engage with school- based networks: Change strategies for influencing and cohering. Journal of Educational Change, 11, 221-240. doi: 10.1007/s108333-009-9125-y

of active participation. Once participation is mapped, information can be transferred to a table in order to evaluate the overall participation of members in the network. Comparative Constituency Feedback surveys (*Keystone | Accountability for Social Change*) provide survey information from stakeholders, particularly the perceptions of those working outside of the network. This information can be used to compare perceptions with similar organizations. This tool is particularly useful because it is relatively inexpensive, can be used at several points in the development of the network, and can be altered to apply to different types of stakeholders.

The Network Function Approach (NFA) is a methodology to evaluate the success of research and policy networks to fulfill core functions. In NFA, each of a network's existing activities is mapped against six functions and stakeholders rate each function for effectiveness and efficiency. The ratings are not the end point, but a starting point for a discussion about the network's mission and how it carries out its basic functions. As such, NFA is the most comprehensive and involved of all of the tools used to evaluate network vibrancy.

Network Connectivity

Network connectivity describes the information and resources that flow through a network. Research into connectivity is technical, dealing with links, nodes and other structural considerations of networks. One way researchers have approached connectivity is through the quality and practice of network communication. Creech's (2004[47]) IDRC report offers the most comprehensive review of network connectivity. By looking at network products available to people and organizations outside of the network, including journal articles, self-published articles, workshops and other documents related to the network's mission, Creech advocates an artifact-centered approach to the evaluation of network connectivity. Creech's research indicates that robust networks not only generate diverse products like research papers, issues papers, policy notes, and newsletters that are available on the network website, but that these products should also be available through other channels. The number of people who contribute to a network's products and an analysis of the relationship the network has with

[47] Creech, Heather and Aly Ramji, Knowledge Networks: Guidelines for Assessment, (Draft Working Paper) IISD, 2004

the mainstream media offer other means to evaluate connectivity (Creech, 2004).

A second element of connectivity deals with internal network communication. Church et al (2002) consider the number of e-mails exchanged, meetings held, and resources exchanged among members to be important indicators of network vibrancy. Holley (2007[48]) goes further to consider how the network facilitates connections and whether network members would otherwise be connected. An intriguing aspect of this research is whether network members are aware of network activity in which they are not directly involved. Awareness and involvement contrasts with the limitations of more traditional organizational forms that tend to compartmentalize involvement and isolate individuals into smaller working groups. If networks function differently, members will have a more holistic understanding of the network's activities and initiatives. According to Earl (2008[49]) the involvement of members is related to the method of governance and the coordination of resources. While there is no one method of network governance, many networks embrace democratic and egalitarian principles. How the governance of networks evolves to maintain these values is of interest to researchers as it influences the way networks are evaluated and perceived by the public.

Social Network Analysis (SNA) heavily influences the tools that researchers use to gather data about network connectivity. SNA encompasses a variety of approaches, but is most often a quantitative approach to analyze the behavioral patterns of network members. SNA usually involves computer-generated mapping techniques, which makes it particularly useful for large networks or networks in which qualitative evaluation is impractical. SNA can be used to calculate the following indices to characterize their social network:

- ***Nodes***: number of school staff responding to the survey
- ***Edges***: number of interactions reported in the survey
- ***Density***: intensity of connections, ranging from 0 where teachers don't interact to 1 where all the teachers interact with each other. Density is calculated

[48] Holley, J, (2007). Mapping the Positive Deviance MRSA Prevention Networks at the VA Pittsburgh Healthcare System Acute Care and Long-term Care Facilities, Plexus Institute Monograph

[49] Katz, S. Earl, L., Ben Jaafar, S., Elgie, S., Foster, L., Halbert, J. & Kaser, L. (2008) Learning Networks of Schools: The Key Enablers of Successful Knowledge Communities. McGill Journal of Education Vol. 43, #1, Winter.

as the number of connections between actors divided by the number of total possible connections in the network.
- ***Degree***: how many people does a teacher reach directly, both in and out
- ***In-Degree***: how many colleagues turn to a teacher for advice
- Out-Degree: to how many colleagues does a teacher turn for advice
- ***Centralisation***: degree to which interactions in a network are centred around one person. Centrality was measured as the total amount of ties an actor receives and sends divided by the size of the network.
- ***In-Centralisation***: direction of the interaction: school staff approaches central person for advice
- ***Out-Centralisation***: direction of the interaction: school staff is being approached by central person for advice
- ***Reciprocity***: level of mutual interaction. Reciprocity was calculated on a scale of 0 to 1, with 0 representing no mutual relationship present in the team, and 1 representing a team in which all relationships are reciprocated, controlling for the size of the network.
- ***Clustering***: the degree to which school staff cluster together
- ***Assortativity***: a preference of school staff to attach to others that are similar on the above indicators

Organizational Network Analysis (ONA) and *Dynamic Network Analysis* (DNA) are variants of SNA designed for the evaluation of connectivity issues in networks that are not primarily social. ONA assesses network relationships and membership changes over time, while DNA describes the structure of relationships over time.

Value Network Analysis (Allee, 2008[50]) is another variant of SNA that maps organizational relationships in terms of the value each member brings to the network. This is a substantial departure from SNA, which tends to focus on the frequency of communication in the network rather than the tangible or intangible contributions of the communication. Not all SNA variants are so technical, Church et al. (2002) proposes monitoring network connectivity by tracking the number of new members gained through traditional and electronic newsletters—something they call Monitoring Networking on the Edges. Partnership

[50] Allee, V. (2008). Value network analysis and value conversion of tangible and intangible assets. Home | ValueNetworks.com. Retrieved May 24, 2011, from http://valuenetworks.com/

Score Card (Lock Lee & Kjaer (n.d.)[51]) and Feedback Analysis (Eoyang & Berkas, 1998[52]) both focus on inter-organizational communication in a network in order to diagnose where and why partnerships are excelling or breaking down.

[51] Lock Lee, L., & Kjaer, C. (n.d.). The partnership scorecard. Optimizing Business Relationships. Retrieved from http://www.optimice.com.au

[52] Eoyang, G., & Berkas, T. (1998, July 5). Evaluation in a complex adaptive system. Home | Human Systems Dynamics Institute. Retrieved from http://www.hsdinstitute.org/learn-more/library/articles.html

Potential effects of networks

Recent analyses indicate that strong networks of teachers and head teachers promote cooperative learning and improvement in, and across schools and enhance effective teaching practices and student achievement (Earl and Katz, 2006; Chapman and Hadfield, 2010; Hargreaves, 2012). Interpersonal relationships and social interaction promote continuous school improvement through the opportunities they provide for information transfer and development of new knowledge between individuals and levels in organisations (Daly et al, 2010; Moolenaar, 2010). Social interactions within schools and formal and informal ties between teachers and head teachers create organisational interdependence of action which affects the direction, speed and depth of improvement of schools (Daly et al, 2010). As Spillane et al (2006) and Mohrman et al (2003) outline, lasting change does not result from plans, blueprints, and events, but from social ties and interactions between individuals.

Strong social networks (high density and high level of reciprocity) are known to support the transfer of tacit, non-routine, complex knowledge, joint problem solving and the development of coordinated solutions, while weak ties are better suited for the transfer of simple, routine information (Daly, 2010). However, Daly and Finnigan (2011) also point out that strong ties and interactions may hinder school improvement when they constrain individuals from making additional ties or from changing the nature of existing relationships. They may limit the introduction of novel information, reduce flexible organisational responses, move redundant information and impede the effectiveness of groups engaged in complex tasks and systemic change (Burt, 1992; Daly and Finnigan, 2011).

Several authors describe the potential effects of strong networks and the type of networks that would contribute to such effects. Potential effects are, according to Muijs et al (2010): school improvement, broadening opportunities (including networking with non-school agencies such as social services or business), resource sharing.
West (2010) summarizes research on potential effects of strong networks, such as a 2005 review study of the Centre for the Use of Research and Evidence in Education (CUREE). Overall, the balance of evidence seems to be that collabo-

rative arrangements can impact on students, though not all do. The review cites 11 studies that have reported changes in teachers' knowledge and skills as a result of network ''interventions'', the majority of which ''led to clearly identifiable behaviour changes'' (CUREE, 2005). The review's comments on school-level impact are disappointing. It seems they were unable to locate anything that had any substantial contribution to make to understanding the ways collaborative arrangements influence school structures and processes. But, there are impacts on the school community reported which themselves imply that something different is going on within schools. The main areas of community development identified are increased involvement of parents in the life of the school and closer links with local communities. Tantalisingly, there is little comment on how such networking arrangements influence either governance arrangements or relationships with the responsible education authority or district personnel.

Evidence that collaborative arrangements have an impact on student achievement suggests, according to West (2010) that the following factors play a role:

- ***Reciprocity***: At the heart of successful collaborations, there needs to be direct benefit to participating stakeholders.
- ***Clear structures***: There should be clearly defined and commonly understood structures for leadership and decision-making.
- ***Institutional relationships***: Relationships between partner organisations are stronger than relationships between individuals from those organisations.
- ***Transparency***: There should be an open and honest articulation of aspirations and expectations and some process to ensure regular review of progress towards these.
- ***Continuity and regularity***: consistent membership and regular communication, with clear timelines that are adhered to.
- ***Acknowledgement of contributions***: The willingness to acknowledge individual contributions and to share credit should itself be a goal of collaboration.
- ***Continual consultation***: New relationships demand the investment of time, energy, and goodwill.
- ***Belief in the collaborative process***: Those involved should believe that more will be achieved by working together than working alone, and this perspective should frame interactions.

Successful collaboration hinged, according to Chapman, Allen and Harris (2004) on the use of key levers within the network. Levers include: a clear focus on teaching and learning, which encourages teachers to focus on and experiment with their own classroom practice; distributed leadership, which draws in the various members of the schools in the network and allocates real tasks to them; a shared commitment to professional development at all levels, including headship; and the capacity to identify and to exploit opportunities for external support. This last point is especially interesting, as it implies that, far from joining together in order to establish a common boundary, successful networks remain open to their environments and the opportunities to draw on resources to be found there.

Network effects involve the evaluation of the overall impact of the network in the broader ecosystem. Creech's (2004) IDRC report emphasizes that network evaluation must determine whether a network is meeting its stated objectives and is fully realizing the open communication and volunteerism that comprises the central advantage of the network structure. To be more than a clearinghouse of ideas, networks must produce knowledge that is relevant to stakeholders.

Another consideration is the centrality of the network within the power structure and organizational ecology of the community (Mitchell & Shortell, 2000[53]; Provan & Millard, 2001). Objective measures of this influence are the number of times the network is referenced in the media, the number of times network members are sought out for public statements, and the number of stakeholders who identify the network as important. The ultimate evaluation of network effects is whether the network has influenced systemic change.

Given the importance of evaluating overall network effects, it is not surprising that there are a variety of tools available for researchers. Evaluation tools fall into two general categories, those that are member-centered and more qualitative in orientation, and those that are systems-centered. Among the ***member-centered approaches***, Church's et al.'s (2002) foundational and prolific work on network evaluation includes at least three different tools to study network effects. *Contribution Assessment* can be used to gauge the level of commitment

[53] Mitchell SM, Shortell SM. The governance and management of effective community health partnerships: a typology for research, policy and practice. Milbank Q. 2000;78: 241–289.

and participation of its members over time in order to understand how members have created value for the network. *Weaver's Triangle for Networks* is a planning tool to help distinguish between a network's goals and objectives and its programs and activities. *Participatory Story Building* is an approach that asks network members to tell their story of involvement in the network. Each member's story is combined in a narrative that attempts to capture essential truths without sacrificing the uniqueness of individual experiences.

Among the more member-centered instruments, *Impact Pathway Evaluation* (IPE) and the *Participatory Impact Pathways Analysis* (PIPA) have been used in complex international development projects. IPE is a two step evaluation process to identify performance indicators that are used to establish plausible links between network activities and developmental changes (Douthwaite, Sculz, Olanrewaju, & Ellis-Jones, n.d.[54]), while PIPA is a process for stakeholders to make explicit their assumptions about network goals in order to set benchmarks for monitoring and evaluation. Both IPA and PIPA have strong educational component that might be useful for groups that are not used to working within networks.

In contrast to network evaluation tools that focus on the experience of individual members, ***systems approaches*** focus on a network's operational environment. The premise of a systems approach is that a holistic analysis of the network and its interplay with other organizations and entities offers a more accurate picture than the focus on discrete network features or members' experiences. *Outcome Mapping* (OM) identifies the network's sphere of influence in order to monitor and evaluate changes in behavior of those groups with which the network interacts directly. OM makes explicit the network's theory of change and takes a learning-based and use-driven view of evaluation (*IDRC | centre de recherches pour le dévelopement international)*. *Network Framework* is similar to OM, but it also evaluates the behavior of members and the internal governance of the network to create a broad measure of internal and external outcomes (International Institute for Sustainable Development (IISD)).

---

[54] Douthwaite, B., Sculz, S., Olanrewaju, A., & Ellis-Jones, J. (n.d.). Impact pathway evaluation of an integrated striga hermonthica control project in Northern Nigeria. Http://boru.pbworks.com/. Retrieved June 24, 2011

Systemic Leverage Index (SLI) is used to evaluate whether networks comprised of different groups attain a broader collective goal. SLI is particularly useful evaluating how the value sets of member organizations influence the direction of the network, and whether the organizations themselves change as a result of participating in the network (International Institute for Sustainable Development (IISD)).

Muijs et al (2010) reflect on theoretical perspectives to explain effects (in improvement of schools) of networking in education, using constructivist organisational theory, the theory of social capital, the ‘‘New Social Movements’’ theory, and the Durkheimian network theory. The constructivist view of the organisation is connected to Vygotskian views of learning. Vygotsky posited that cooperation lies at the basis of learning, through the way in which interaction leads to scaffolding that allows actors to achieve more than they would be able to do individually; new knowledge emerges as groups work together towards the achievement of joint goals. In order for learning and growth to occur, collaborating organisations need to have sufficient cognitive distance for new insights to emerge but at the same time need to be similar enough for dialogue to be possible and constructive (Nooteboom, 2004). Communication and collaboration between organisations over time will, however, lead to organisations becoming more similar to one another (Brass, Galaskiewicz, Greve, & Tsai, 2004). This could facilitate communication but could conversely encourage myopia in the collaborative.

A related theory on the importance of networking focuses on the value of networking and collaboration in creating social capital. The value of networking in this perspective is seen as lying in its ability to harness resources held by other actors and increase the flow of information in a network. Furthermore, a network can exert more influence on its social and political surroundings than individual actors (Lin, 1999). Social capital can also help spread innovation, which, according to Hargreaves (2004), is best done through bottom-up networks that can both quickly link schools to innovators and may themselves lead to innovations that are more open to change and challenge and less likely to ossify than top-down strategies. Knowledge lies in different minds, both individual and collective, and therefore networks are needed to increase effectiveness. The value of networking lies in spanning ‘‘structural holes’’ where information or skills

are lacking (Burt, 1992). This makes collaboration a potentially fruitful strategy for all actors involved in a network, as each may in theory be able to span structural holes, something which becomes more likely when a network consists of several actors. In this view, networking can be unsuccessful where there is too strong an imbalance between actors in terms of what information/skills they posses or where structural ties can imprison actors in negative behaviour patterns.

Available research methodology to evaluate and monitor networks

The argument is that networks represent a paradigm shift in the way people organize, share information, and solve problems. That businesses, government agencies, and non-profit organizations are rapidly adopting network-centric principles in order to utilize limited resources and solve complex problems (Goldsmith & Eggers, 2004[55]) suggests that networks might also be a mechanism for change in educational settings like schools.

Network-centric activity is unlikely to emerge as a change strategy in educational settings, however, until several elements are in place. First, networks must have a clear conceptual framework that is easily understood by educators, educational-policy makers, and the public. Second, educational leaders on the school levels must be committed to supporting a network-centric change model. Third, a way to evaluate network-centric educational change must be in place. This chapter will further develop the first two points while creating a conceptual framework for the monitoring and evaluation of networks in educational settings.

Social network theory

Relationships are important; social network theory gives us a lens to understand relationships. Social network theory helps to explain how human capital can be leveraged and increased through relationships. These relationships are critical in ensuring the flow of information and the creation of innovative ideas (Balkundi & Kilduff, 2005; Borgatti & Cross, 2003; Brass, Galaskiewicz, Greve, & Tsai, 2004[56]). The goals and objectives of an organization can be realized more easily when actors within the organization have quality relationships with co-workers.

---

[55] Goldsmith, S., & Eggers, W. D. (2004). Governing by network: The new shape of the public sector. Washington, D.C.: Brookings Institution Press.

[56] Brass, D. J., Galaskiewicz, J., Greve, H. R., & Tsai, W. (2004). Taking stock of networks and organizations: A multilevel perspective. Academy of Management Science, 47(6), 795-817.

Social network data describe the relationships between actors. These data tell us, for example, how actors are similar to other actors in the choices that they make about with whom they have relationships. A key feature of social network data is that they show us an actor's "embeddedness" within a social network.

Embeddedness can be described an actor's position in the network or, in other words, how an actor fits into the overall network (Adler & Kwon, 2002[57]; Balkundi & Kilduff, 2005[58]; Daly, 2010[59]; Lin, 2001[60]). The focus of social network data is the relationships among actors (Kadushin, 2012[61]). The individual attributes of actors are not sampled in isolation. If a researcher were interested in how a principal uses data to inform instructional decisions, the researcher would probably survey the entire teaching staff at the site. The focus would move from the attributes of the individual to the relationships that exist between the principal and the teachers. Social networks illustrate social capital and they help us to understand relationships among actors in the organization.

Actors in a social network can be people who work together in an office, members of a family, neighbors who live within a specific area, or any number of other groups of people. Networks can also be described as departments within an organization or business, municipalities, and even countries that interact for a variety of reasons. The variations of types of networks are infinite. Social networks are a well-studied phenomenon. There is a vast body of research that addresses a variety of research questions about social networks and how they are structured.

Social networks are important because the connections between and among actors have implications for how information is processed in the organization and

---

[57] Adler, P. S., & Kwon, S. (2002). Social capital: Prospects for a new concept. The Academy of Management Review, 27(1), 17-40.

[58] Balkundi, P., & Kilduff, M. (2005). The ties that lead: A social network approach to leadership. The Leadership Quarterly, 16, 941-961.

[59] Daly, A. J. (Ed.). (2010). Social network theory and educational change. Cambridge, MA: Harvard Education Press.

[60] Lin, N. (2001). Social capital: A theory of social structure and action. Cambridge, UK: Cambridge University Press.

[61] Kadushin, C. (2012). Understanding social networks: Theories, concepts, and findings. New York, NY: Oxford University Press.

how innovative ideas can be generated (Frank, Zhao, & Borman, 2004[62]; Kadushin, 2012[63]; Lin, 2001). Researchers, based on the questions that they ask actors in social network surveys, can manipulate the data that they receive in a variety of ways. Results of social network analysis may help organizations to answer questions such as which departments are most engaged in collaborative groups, which actors are working alone, and who are the actors in the organization to whom people go to for help. These results have implications for improving production and advancing the mission of the organization.

Social network theory can be applied to analyze groups of varying sizes from small groups, to organizations to global enterprises (Daly, 2010; Kadushin, 2012). Dyads — connections between two people, and triads — connections between three people, are the basic structures from which networks are formed. A network is simply a set of relationships between two or more objects. These objects, or nodes, can be people. A relationship may be as simple as two people standing in a line at a coffee shop. Directional relationships can be symmetrical or asymmetrical. In symmetrical relationships, there is mutuality. An example of a mutual relationship is one where both people love each other or where both people count on each other for advice. Some relationships go through an intermediary and are not reciprocal. These may be transitive relationships, which are hierarchical. For example, management gives directions to a supervisor, who then directs a worker. In a transitive network, all three nodes are linked. In this case, the network is represented as a sociogram. The smallest sociogram has three nodes. These simple sociograms form the building blocks of larger, more complex sociograms.

Although software exists to fit each of network models to real data, they have seldom been used in education research. Exceptions include two policy studies,

---

[62] Frank, K. A., Zhao, Y., & Borman, J. (2004). Social capital and the diffusion of innovations within organizations: The case of computer technology in schools. Sociology of Education, 77, 148-171.

[63] Kadushin, C. (2012). Understanding social networks: Theories, concepts, and findings. New York, NY: Oxford University Press.

Penuel et al. (2010[64]) and Weinbaum et al. (2008[65]) to study communication among teachers regarding an initiative. Both studies analyze types of communication across several schools by fitting a separate, single-network model for each school. But the models for different schools are not linked in any way, and comparisons are based exclusively on qualitative assessments of the parameter estimates in each model. There is a good reason for this: existing social network models are mostly inadequate for the types of problems studied in education research. Comparing different treatment conditions in an intervention study requires models that can accommodate at least two networks, as well as parameters for treatment effects. Moreover, education interventions generally involve several schools (i.e. professional social networks) in each condition, but again existing social network models are largely confined to fitting one network at a time.

To address these needs, Sweet, Thomas & Junker (2011[66]) introduced a new modeling framework, the Hierarchical Network Models (HNM) framework. This framework allows us to borrow strength across multiple partially-exchangeable networks for parameter estimation, as well as pools information from multiple networks to assess treatment and covariate effects. Some pioneering work with multi-level structures for multiple networks has been done by Templin et al. (2003[67]) and Zijlstra et al. (2006[68]) but the proposed framework of Sweet c.s is more general: HNMs can accommodate all three network models above in a multiple-network setting, as well as essentially arbitrary network level experimental interventions.

---

[64] Penuel, W., Riel, M., Joshi, A., Pearlman, L., Kim, C., & Frank, K. (2010). The alignment of the informal and formal organizational supports for reform: Implications for improving teaching in schools. Educational Administration Quarterly, 46(1), 57–95

[65] Weinbaum, E., Cole, R., Weiss, M., & Supovitz, J. (2008). Going with the flow: Communica- tion and reform in high schools. In J. Supovitz & E. Weinbaum (Eds.), The implementation gap: understanding reform in high schools (pp. 68–102). Teachers College Press.

[66] Sweet, T.M., Thomas, A.C. and Junker, B.W., (2011). Hierarchical Network Models for Education Research: Hierarchical Latent Space Models. Pittsburgh: Department of Statistics ,Carnegie Mellon University December 8, 2011

[67] Templin, J., Ho, M.-H., Anderson, C., & Wasserman, S. (2003). Mixed effects p* model for multiple social networks. In Proceedings of the American Statistical Association: Brain Imaging Section, San Francisco, CA. American Statistical Association.

[68] Zijlstra, B., van Duijn, M., & Snijders, T. (2006). The multilevel p 2 model. Methodology: European Journal of Research Methods for the Behavioral and Social Sciences, 2 (1), 42–47.

Other Approaches to the Study of Networks

Before networks emerged as dynamic and complex organizational forms that compete directly with hierarchical organizations – which is to say before the emergence of the Internet–articles in education journals that mentioned networks generally did so by describing network emergence and the position of networks in the broad ecology of organizations. There was little attempt to understand a network's discrete features because the challenges of coordinating activity before the Internet limited the size and scope of networks. Lieberman and Grolnick (1997[69]) along with Hargreaves wrote passionately about educational networks like the National Writing Project, Breadloaf, and Firefox, but they could not have predicted the profound changes in network activity precipitated by the emergence of the Internet in the 1990s and 2000s. Ironically, the limited attention networks received in the 1980s and early 1990s waned just as networks themselves were being transformed through new information communication technologies (ICTs).

Even though networks did not receive much attention from educational researchers in the 1980s and 1990s, they did interest public policy researchers investigating the influence of networks and coalitions in the formulation of public policy. As developed by Sabatier and Jenkins-Smith (1993[70]), the Advocacy Coalition Framework (ACF) is based on the premise that it is logically impossible to understand any reasonably complicated situation–including almost all policy development – without making the underlying theory explicit and inviting empirical verification. According to ACF, policy change is a function of three distinct processes. The first concerns the interactions of competing advocacy coalitions within a policy subsystem. The second concerns external influences on the subsystem. The third relates to parameters that constrain the various actors in the subsystem.

The ACF has four major premises. The first is that understanding the process of policy change requires a time frame of at least 10 years. Second, the best way to

---

[69] Lieberman, A., & Grolnick, M. (1997). Networks, reform, and the professional development of teachers. In A. Hargreaves (Ed.), Rethinking educational change with heart and mind (pp. 192-215). Alexandria: ASCD.

[70] Sabatier, P. A., & Jenkins-Smith, H. C. (1993). The advocacy coalition framework: Assessment, revisions, and implications for scholars and practitioners. In P. A. Sabatier & H. C. Jenkins-Smith (Authors), Policy change and learning: an advocacy coalition approach (pp. 211-236). Boulder, Colo.: Westview Press.

study policy change is by observing the key players who seek to influence the development of policy. Third, studying policy change also involves studying the internal dynamics of the policy makers. Last, policy formation is similar to a belief system in that values are transformed into public policy (Sabatier & Jenkins-Smith, 1993).

The extended time frame necessary to conduct ACF research is a significant impediment to its widespread use. Nevertheless, there are at least two examples of ACF being used to look at education policy development. Mawhinney (1993[71]) uses ACF to examine the complexity involved when enacting policies related to French-language educational programs in Ontario, Canada. Among the conclusions, the author finds that contemporary policies evolved from ongoing debates dating from Ontario's early history, policy enactment involved multiple governmental levels (local and provincial boards), and policies reflected a fundamental shift in the educational ideology that had guided previous policy decisions. Mawhinney concludes that the use of ACF emphasized the interaction of opposing coalitions, the analysis of external (contextual) forces, and addressing the underlying belief systems of those working on policy (Mawhinney, 1993). These elements are particularly important when studying network activity because they account for a network's inherent complexity.

Using ACF increases the likelihood that researchers will consider the dynamic nature of network activity over time, and not focus on the success or failure of a particular policy position. The use of ACF in the 1980s and early 1990s makes sense in that network activity was most visible and active in debates involving public policy issues and ACF was designed to answer macro-level questions. ACF remains an excellent research methodology to understand the influence of coalitions over time. ACF is inadequate, however, when trying to understand how and why a network might be more effective at solving a problem than a hierarchical organizational structure.

Although the number of people participating in networks has grown exponentially in the last several years, the number of people developing network evalua-

---

[71] Mawhinney, H. B. (1993). An advocacy coalition approach to change in Canadian education (P. A. Sabatier & H. C. Jenkins-Smith, Eds.). In Policy change and learning: An advocacy coalition approach (pp. 59-82). Boulder, Colo.: Westview Press.

tion instruments remains small, and tends to be affiliated with the research divisions of international development organizations or social scientists involved with social change networks. As a result, most network evaluation instruments are designed for policy-change networks, advocacy networks, or social change networks. Even though most of the research conducted is not related to education, these network evaluation instruments are relevant for educators and educational policy-makers because they focus on universal network elements.

Analyzing whole social networks requires that researchers describe and summarize its various aspects. A number of methods have been utilized for this purpose. Distributions of networks describe the number of dyads and triads. Other distributions include density — the number of connections in the network, structural holes — the lack of connections, and strength of weak ties — the theory that important knowledge flows though individuals who have limited connections (Ahuja, 2000[72]; Granovetter, 1983[73]). Centrality shows that some nodes have more connections than others and that these connections serve as links to others in the network. Distance is key in analyzing network data. It measures the distance across nodes. Multiplexity looks at how different networks connect with one another. Finally, positionality examines how nodes relate to one another in a network. Sociograms can be used to depict these relationships.

Towards an Evaluation Instrument for Networks in Education

The same characteristics that make networks compelling and desirable: rapid growth and diffusion of ideas, coordinated action and hyper connectivity, resilience and adaptability, also create unique challenges for researchers developing frameworks for monitoring and evaluation. Networks are complex and their features vary widely depending on their size and focus. Yet, the development of effective evaluation instruments is a crucial step in the funding and general acceptance of network organizations as they emerge in diverse sectors of our society. While many of the instruments described in the previous section are currently being used to evaluate international development and social change net-

[72] Ahuja, G. (2000). Collaboration networks, structural holes, and innovation: A longitudinal study. Administrative Science Quarterly, 45(3), 425-455.

[73] Granovetter, M. (1983). The strength of weak ties: A network theory revisited. Sociological Theory, 1, 201-233.

works, no single instrument is accepted and there is widespread recognition that network development has outpaced tools for network assessment.

That a single approach toward network assessments has yet to emerge is not necessarily a bad thing, particularly because the absence of a dominant approach allows for the development of instruments that are specific to the sector in which the network operates. For educational reform networks seeking members, funding, legitimacy and influence, the development of network evaluation tools is a challenge and a necessity.

While there is very little research on networks in education, the research on the monitoring and evaluation of networks in education is nonexistent. As noted earlier, a few studies in the 1980s and 1990s used the Advocacy Coalition Framework (ACF) to study educational policy change, and ACF remains a viable approach when studying policy change over 5-10 year periods of time. ACF was not designed, however, for the study of discrete network features or the organizational ecology in which networks function. In addition, ACF was developed before information and communication technologies (ICTs) became a key driver of organizational change. Not surprisingly, recent studies looking at social networking among students and teachers (Schlager et al, 2009[74]; Penuel & Riel, 2007[75]) have utilized social network analysis (SNA), but as previously pointed out, SNA is designed for the analysis of relationships and communication within the network, not for network evaluation. Despite its narrow focus and limitations, SNA will continue to be the default method of network evaluation until an alternative that accounts for both discrete network features and overall network effects is developed.

Grau and Nunez (2007[76]) have developed a conceptual framework for a "participatory approach" to network evaluation that might serve as the foundation for

---

[74] Schlager, M. S., Farooq, U., Fusco, J., Schank, P., & Dwyer, N. (2009). Analyzing online teacher networks: Cyber networks require cyber research tools. Journal of Teacher Education, 60, 86-100. doi: 10.1177/0022487108328487

[75] Penuel, W. R., & Riel, M. (2007). The "new" science of networks and the challenge of school change. Phi Delta Kappan, 88, 611-619.

[76] Wilson-Grau, Ricardo and Martha Nuñez. 2007. "Evaluating International Social Change Networks: A Conceptual Framework for a Participatory Approach." Development in Practice, 17(2): 258-271.

	Political Purpose and Strategies	Organization and Management	Leadership and Participation
Democracy	1. Members share a vision and mission. 2. Members have a sense of ownership of the network.	3. Members contribute and have equitable access to network resources. 4. The leadership structure is minimally hierarchical.	5. Network leaders are qualified and committed to the network.
Diversity	6. The diversity of members reflects the network's purpose and strategies. 7. The strategies of the network reflect skills of the network members.	8. Work and decision-making is distributed to create redundancy and avoid dependence on a few members. 9. Internal conflicts do not compromise the network's capacity to act.	10. Internal communication is open, inclusive, and emphasizes trust. 11. External communication is as open as possible. 12. Network members participate in projects that utilize their skills. 13. Members interact constructively, and in a manner enriched by differences. 14. Network members are accountable to one another. 15. Members' contributions are recognized.
Dynamism	16. Mechanisms exist to reformulate strategies and adjust to obstacles. 17. The network pursues clearly defined projects that are aligned with the mission.	18. Obstacles to participation (i.e. rules and membership requirements) are minimal. 19. The network expands and contracts as needed. 20. Organizational culture is consistent with network principles.	21. The network is committed to innovation. 22. The network coordinates with other organizations when appropriate. 23. The network seeks alliances and new strategies to carry out the organization's mission.
Effectiveness	24. Projects are based on an up-to-date analysis of the environment in which the network operates. 25. The network has a clear organizational identity for members. 26. The network is a key player in the work to achieve long-term change in the environment in which it operates. 27. The network affiliates with state, regional and national organizations that share core values. 28. Work is planned, monitored, and evaluated internally and externally.	29. The network is autonomous. 30. As needed, policies are enacted and followed. 31. Resources necessary to carry out network projects are identified and acquired. 32. The financial structure is transparent and the network manages its financial resources carefully.	33. Members influence the development of the network and the coordination of network activities. 34. Members become more committed and effective as a result of their participation in the network.

the evaluation of networks in education. The framework, which borrows from

Church et al.'s (2002) foundational work, accounts for two fundamental differences between networks and traditional organizations: first, that networks operate on the voluntary cooperation of its members, and second, that the command and control structures of traditional organizations rarely work in a network. Since the monitoring and evaluation of organizations often focuses on these very features, Grau and Nunez offer an approach that evaluates four qualities unique to networks as an organizational form: 1) democracy, 2) diversity, 3) dynamism, and 4) performance. *Democracy* describes member participation in decision-making as a means of ensuring that program implementation will be fully implemented. *Diversity* describes the unique strength of networks to bridge differences in the pursuit of the network's common aim. *Dynamism* refers to the enthusiasm that members bring to network projects without the need for rewards like salary and recognition. *Performance* describes the quality of interactions between members that lead to organizational success.

Grau's and Nunez's participatory approach offers an important advantage over other instruments because it can be easily customized to fit the context in which the network operates. Although originally designed for social change networks, the framework's three "operational dimensions" can apply to nearly all networks, including networks in education. The first operational dimension, *political purpose and strategies*, describes the way in which the network develops and maintains its reason for being. It answers the fundamental questions: what does the network want to achieve? What values motivate its members? A second operational dimension, *organization and management*, focuses on the way the network coordinates management, capacity, and communication. As in other similar instruments, this is the largest dimension because it is related to the operation of the network. The third dimension, *leadership and participation*, looks at the interconnection between members and leadership. From the four qualities and three operational dimensions, Grau and Nunez offer a matrix of 56 indicators that serve as a menu of potentially relevant performance attributes. As might be expected for an evaluation tool developed for social change networks, not all questions are relevant for education reform networks. Therefore, the original matrix has been edited to focus on those questions that are applicable for networks engaged in educational reform.

The questions in the matrix offer the content for a comprehensive network evaluation instrument, but are not a methodology by themselves. Wilson-Grau and Nunez suggest that any decision about methodology derived from the matrix must be made on network-by-network basis. Nevertheless, it seems clear that the questions are most consistent with a questionnaire. A questionnaire offers several advantages, including the opportunity to derive both qualitative and quantitative data, to repeat the questionnaire and generate longitudinal data for a single network, and to compare the performance of different networks. Whatever form the questions in the matrix ultimately take, Wilson- Grau and Nunez emphasize that network evaluations will ultimately need to answer the following overarching questions:

1. What evidence is there that the network contributed to change?
2. What was the role of other social actors and contextual factors?
3. To what extent was the network's intended outcome achieved, whether formally planned or not?
4. Were other political outcomes achieved? (Wilson-Grau & Nunez, 2007).

One of the significant advantages to a participatory approach to network evaluation is that it is consistent with network principles like participation, learning, and collective decision-making. Whether conducted using questionnaires, internal and external evaluation teams, or using a hybrid model involving multiple approaches, a participatory approach means involving network members in the evaluation process. This should not only make the results more relevant, but should also build capacity to make ongoing improvements between formal evaluations. There are similar advantages for external evaluators, whether those evaluations are conducted by donor agencies or accrediting agencies. Meaningful involvement of network members during evaluations leads to a more reliable overall evaluation. The validity of evaluation results is particularly important for networks in educational settings because the monitoring and evaluation of programs associated with schools and school districts have traditionally ignored the input of teachers. Participatory evaluation offers an opportunity to involve educators in meaningful ways, and by doing so, make programs more responsive to the stakeholders most involved in the implementation.