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# Social Network Analysis for School Librarians to Evaluate and Improve Teacher Collaboration

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*This paper describes doctoral research that sought to determine if school librarians could use social network analysis as an evaluative and strategic planning tool. The study used a mixed-methods approach to develop and pilot test the Social Network Analysis for School Librarians (SNASL) Process in two secondary schools (ages 11-18) using participatory analysis. Analysis revealed that the SNASL Process has the potential to enable school librarians to evaluate and improve upon the collaborative network of their school by identifying individuals in specific role positions and producing generative insight regarding the structure of the school network.*

## Introduction

Since the first professional standards and guidelines for the school librarian in 1988, the American Association of School Librarians (AASL) has included some form of instructional partnership as one of the roles of the school librarian (American Association of School Librarians & Association for Educational Communications and Technology, 1988). Not surprisingly, teacher and school librarian collaboration is a main theme in the professional literature, as well as research, focusing on: the role of the school librarian as instructional partner (Ballard, 2009; Loertscher, 2014); views of collaboration (Asper, 2002; Bush, 2003); encouraging teachers to collaborate (Brown, 2004; Gess, 2009; Hylen, 2004; Morris, 2015); theories of collaboration (Montiel-Overall, 2005, 2008, 2010); impact of collaboration on students (Dadlani & Todd, 2016; Vermillion & Melton, 2013); and how to collaborate effectively (Buzzeo, 2010; David, 2008; Harvey II, 2008; Husid, 2013; Johnson, 2010; Lankau, 2015). Yet, school librarians report that one of the major challenges they face is teacher collaboration. They complain that “it does not happen often enough, and the collaboration that does take place many times does not approach a level where the school library media specialist would be considered an indispensable member of the instructional team” (Cooper & Bray, 2011, p. 48). The answer to this problem is often tantamount to build it and they will come. School librarians are urged to start small, work with the teachers who are willing to work with them, continue to communicate, and hope that eventually the other teachers in the building will see the value of collaboration (Gess, 2009). Although this is necessary and useful advice, it requires a large investment of time and energy and has an uncertain result. Some teachers will respond to this approach, while others will not. Additionally, a school librarian that is new to a school may not be fully aware of the existing collaborative structure of the school. He or she may waste time in rebuilding relationships with the library that already existed or focus energy in a haphazard way. Although school librarians must reach out to teachers to build collaborative opportunities, this by itself, without a holistic and systematic approach, offers a murky and unknown result.

In this study, I investigated the question “How can social network analysis be used by school librarians to evaluate and improve the collaborative networks in their school?” In order to answer this question, I developed a method titled the Social Network Analysis for School Librarians (SNASL) Process using social network analysis and then pilot tested at two schools in a mixed methods approach utilizing participatory analysis by the school librarians.

## Literature Review

A review of the research suggests that the tools and information provided through social network analysis offers schools a means of systematically analyzing their existing collaborative networks. School librarians can then use this information to strategize their collaborative attempts and better understand the collaborative structure of their building. With a basic understanding of social network theory and using social network analysis to investigate networks within a school, a school librarian that is new to their building - regardless of their years of experience - can quickly get a picture of how much collaboration occurs in their building and establish an intentional plan for increasing teacher and school librarian collaboration that allows them to manage and leverage their interactions with colleagues.

Social network analysis is grounded in social capital theory, which is defined as “features of social organization, such as trust, norms, and networks, which act as resources for individuals and facilitate collective action” (Lochner, Kawachi, & Kennedy, 1999, p. 260). For example, in a network of friends where everyone is connected to everyone else, all members tend to exchange information and resources, trust each other, and share similar attitudes (Coleman, 1988). In contrast, individuals with no ties to each other have difficulty exchanging resources and ideas because there are no established ties from which those ideas and resources can flow.

In contrast, human capital is internal to the individual and consists of the knowledge, experience, abilities, and skills that one possesses. One way to distinguish between social capital and human capital is that human capital is a quality possessed by an individual; whereas, social capital is a quality created between people (Burt, 1997). In the world of education, as with many other fields, social capital can be more concretely defined as access to valuable resources (e.g., lesson materials, information) through one's social relationships with others.

As other researchers and theorists have taken up a social capital framework and approached the idea from different perspectives using various forms of evidence, they all operate under the assumption that “better connected people enjoy higher returns” (Burt, 2000, p. 347). In fact, human capital of teachers benefits other teachers more than it benefits the individual who possess the capital (Pil & Leana, 2009), helping to demonstrate that it is not the human capital of the individual that is most important but the social connections within the organization that define success.

## **Social Network Theory**

Social capital theory foregrounds how relationships are necessary to access the information and resources possessed by others; in contrast, social network theory reveals the patterns in the social structure that enable social capital to exist (Burt, 2000). Social network theory is a mechanism for understanding the social capital relationships between embedded individuals in a particular system. Because social network theory illuminates the relationships between individuals, it may be useful as a tool to understand how school librarians and teachers can collaborate more strategically.

One of the advantages of social network theory is the dual nature of the study of the individual and the group. Therefore, it is uniquely situated for the study of the school librarian in the greater context of the social relationships within the school. Social network theory offers a holistic perspective in which macro level actions produce micro level interactions and vice versa (Coleman, 1990).

Most social network studies of the educational environment examine system-wide macro-level features of schools, such as the density or centrality of the whole network. These system-level measurements are useful in examining the change in schools over time and comparing multiple schools. On the other hand, ego-level measurements - those that measure the characteristics of a specific individual in the network - enable the researcher to understand how individuals interact with each other within a network (Coleman, 1990). Understanding the characteristics of a particular

individual can enable the researcher to ascertain their role in transmitting or receiving information and resources to others in the network.

As a participant researcher in the community, school librarians using social network analysis gain the ability to understand their own role in the system and how they interact with individuals and subgroups in the social network of their schools. By first noticing the characteristics of individuals within the network, the participant researcher can use that information to create a strategic plan to leverage or modify those characteristics. At the individual or actor level, the position of an actor within a network can determine whether they have a structurally advantageous position and thus have greater access to knowledge and resources, or more control over knowledge and resources (Burt, 1995). Therefore, understanding teachers' network positions may be useful in understanding how resources (knowledge and information) support or constrain their efforts at improving student achievement (Baker-Doyle, 2011; Coburn & Russell, 2008; Moolenaar, Slegers, & Daly, 2011; Penuel, Riel, Krause, & Frank, 2009).

### ***Individual Network Positions***

There are four network positions commonly referred to in the business community (Cross & Parker, 2004): information broker, central connector, boundary spanner, and peripheral people. Each role plays a unique position within an organization. Identification of individuals within these role positions can be used to strategically improve social capital in the organization and therefore improve student academic achievement.

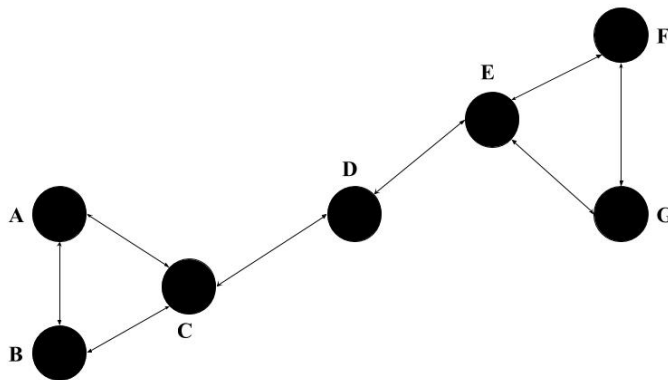
Overall network structure is important for understanding organizational phenomena, but so too are individual network positions. These positions are related to the different types of relationships an actor possesses and the amount of those relationships. At the individual or actor level, the position of an actor within a network can determine whether they have a structurally advantageous position and thus have greater access to knowledge and resources, or more control over knowledge and resources (Burt, 1995).

Teachers with high levels of social capital have a greater opportunity to use and expand that social capital to improve student learning. Therefore, understanding teachers' network positions may be useful in understanding how resources (knowledge and information) support or constrain their efforts at improving student achievement (Baker-Doyle, 2011; Coburn & Russell, 2008; Moolenaar et al., 2011; Penuel et al., 2009).

***Boundary Spanner.*** A boundary spanner serves as a broker, connecting subgroups within an organization. School librarians fulfill this role naturally, operating on the boundary between teacher and library. Van Deusen (1996) suggested a similar when he observed in a case study that the school librarian provided leadership as an "insider/outsider." In this situation, the school librarian added value through her knowledge of quality resources for instruction. However, since she was not a supervisor, she was a safe source for assistance and information. Since school librarians are in a central and traditionally non-threatening position within a school, they are in a unique position to bridge the structural holes that might exist between departments and grade levels.

Bridging structural holes is important to effective collaboration. A network with distributed expertise and many weak ties has little redundancy. Information within cliques is often redundant, since people closely connected to one another tend to have access to the same resources and research has shown that people rely on previously established communication channels (Hansen, 1999). When structural holes are brokered, the additional flow of information ensures that both groups have access to the information flows within the groups. The more structural holes spanned, the richer the information within the network.

Thus, it is important that brokers exist to bridge structural holes and enable new knowledge to flow into existing cliques. The broker, often referred to as a boundary spanner, spans the hole and serves in this role (Cross & Parker, 2004), as seen in Figure 1.



**Figure 1. Boundary Spanner.**

**As Figure 1 suggests, Actor D is a boundary spanner because this actor connects multiple subgroups within the network. Enabling cliques with purposeful information, boundary spanners can improve workflow, since each clique can focus on its own work without the distractions of other needs, but can also have consistent information regarding the other groups.**

In the academic library, the liaison school librarian often serves this role. The liaison school librarian is part of an academic department as well as the library itself. By engaging in both departments, they can broker information between the two groups ensuring that each group's needs are met. Although this is not as common within schools in the school setting, it does occur within departments in a single school or between a school and the district office. A teacher who is well connected to the district office might hear about new curriculum resources or reform initiatives in advance of other teachers and can thus spread the information to his or her department quickly. School librarians can make a point to become this individual by forming the necessary connections, and thus become more central to the information flow in the school building.

**Central Connector.** A central connector is highly sought after and therefore has greater access to information and social support from the network. In-degree and out-degree are two important ways that this is described. Actors with a high in-degree are sought after for resources and knowledge, whereas actors with a high out-degree seek out resources from others (Burt, 1995; Wasserman & Faust, 1994). Those with a high in-degree, by nature of their position, have a disproportionate influence over others in the network as they have more relationships with which to access resources (Daly et al., 2010; Hanneman & Riddle, 2005). These individuals tend to be centrally located in the network and as such, have a greater ability to leverage resources compared to more peripheral individuals (Tsai, 2001). However, large numbers of direct ties can also drain an individual's resources because they require time and effort to maintain (Balkundi & Harrison, 2006). Furthermore, the social norms present within the group may constrain an individual's behavior defined by those ties (Burt, 1995). Therefore, a central connector may be perceived as an expert in the system, but they may also be a bottleneck that is holding up the flow of resources and information.

Educational researchers often refer to the total or average number of relationships as a measure of closeness centrality. Another way this is expressed is as the total number of relationships

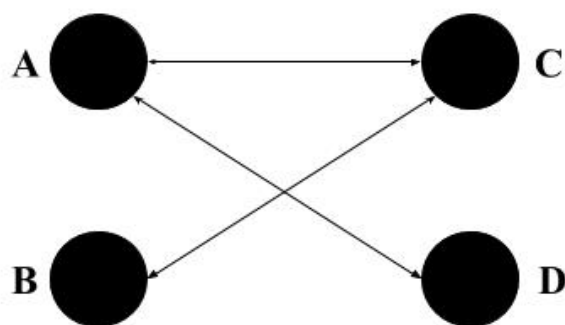
in relation to the total number in the network (Burt, 2000; Cross & Parker, 2004; de Jong, Moolenaar, Osagie, & Phielix, 2016). In other words, how close is one person relative to others in the network. A teacher with a high closeness centrality will have few steps between the other actors in the network as measured by geodesic distance; central connectors are those individuals with the lowest geodesic distance values. Being centrally located means that the information a person distributes will reach the rest of the network more quickly (Freeman, 1978).

For example, in the matrix illustrated in Figure 2, B is one step away from C, meaning that they are directly connected.

	A	B	C	D
A	0	2	1	1
B	2	0	1	3
C	1	1	0	2
D	1	3	2	0

**Figure 2. Geodesic Distance Matrix Example**

In contrast, B is three steps away from D, meaning that for information to flow between B and D in that network, it must go through two other people before reaching D. This can be visualized in Figure 3.

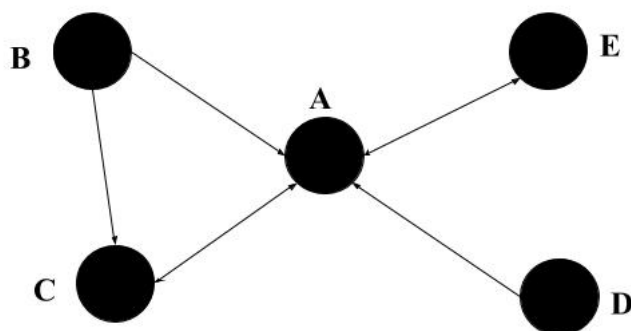


**Figure 3. Network Diagram for Data in Geodesic Distance Matrix**

**Information Broker.** Information brokers sit on the shortest path between the remainder of the network. These individuals disproportionately affect information flow and can be leveraged to promote connectivity within the network (Cross & Parker, 2004). Since an information broker is likely to have a large number of ties in the network and also serve as a bridge between disconnected actors, potential information brokers can be identified using the broker and normalized broker measurements. Broker is the number of pairs that are not directly connected, but bridged by the given actor. Normalized broker (nBroker) is the broker divided by the total number of pairs, or the percentage of pairs for which the actor serves as broker. An individual with a high broker value has more influence in the network, as they are a pathway for information to flow amongst members of the network and thus can determine where and when information flows.

Because of their position in the network, information brokers, like boundary spanners, also bridge structural gaps. However, unlike boundary spanners that link specific subgroups, where ties

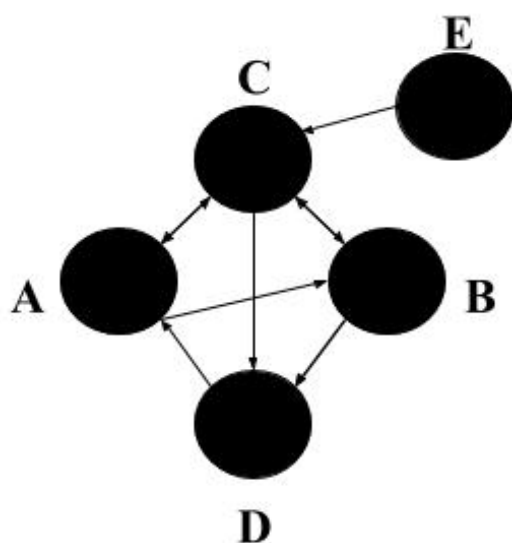
are likely to be strong, information brokers link a variety of actors within the network, many of whom may have weak or non-existent ties, as shown in Figure 4.



**Figure 4. Diagram of Information Broker**

As Figure 4 shows, Actor A is an information broker, because they serve as a central point for information sharing across disparate areas of the network. This bridging allows them to receive and disseminate a large amount of information to and from different actors within the network. This combination of information from weakly connected actors contributes to innovation within the network by enabling information to flow in ways that it would not without the information broker (Burt, 1995).

**Peripheral People.** Peripheral people operate on the perimeter of the social network. They have few ties to the other actors in the network, measured by ego network size (Borgatti et al., 2002; Cross & Parker, 2004), as seen in Figure 5. These individuals may have underutilized skills, expertise, and unique perspectives that are not being leveraged by the school.



**Figure 5. Diagram of Peripheral Person**

As Figure 5 shows, Actor E is on the periphery, as they are loosely connected to the rest of the network. Individuals may be on the periphery because they wish to be there or because they are not sure how to work their way inside (Cross & Parker, 2004). Identifying these individuals can allow school librarians to form mentoring relationships, introduce them to others, or get them involved in bigger projects. Identifying these individuals and pulling them into other projects helps the school librarian become a boundary spanner or information broker, a bridge between individuals in the network, increasing his or her impact and perception of value.

Using social network analysis to identify periphery people is the first step. However, additional qualitative data is needed to determine why the individual is on the periphery (Cross & Parker, 2004). Some individuals are on the periphery by choice. Pushing them to be involved may reduce their morale or reduce their own work effectiveness. It is important to get to know people to understand these distinctions. For example, if a specialist is too busy helping others, they may not have the time to stay ahead in their field.

Regardless, enabling peripheral people to build more network ties increases the social capital of the entire organization, as their knowledge and resources become more easily accessible by other teachers.

### **Piloting the Social Network Analysis for School Librarians (SNASL) Process**

I conducted the study in a mid-size suburban school district in Alaska. Two pilot schools consented to participate in the study. To gather the social networking data necessary for evaluation, I created, field-tested, and disseminated the Alaska Teacher Social Network Survey (ATSNS) first at a staff meeting, with follow up online for those staff members that were not present. I made multiple attempts to get as close to 100% participation as possible with final numbers at 95.2% (N=40) for Pilot School One and 67.7% (N=42) for Pilot School Two.

I anonymized all data to maintain confidentiality but to enable the school librarian participants and I to identify the subject area of the given teacher. Social network statistical analysis and diagrams were generated by UCINET 6 for Windows and its NetDraw component (Borgatti, Everett, & Freeman, 2002) after data was input. UCINET was chosen due to its relative ease of installation, accessible help materials, free trial availability, and frequency of use in communication research. For example, the science teachers were labelled, Sci A, Sci B, Sci C, etc. The librarian was coded as "Library." History and social studies teachers were labelled "Soc" and so on.

After data were collected through the ATSNS, I transferred them to an adjacency matrix by using Excel, as shown in Figure 6, and then uploaded the Excel file to UCINET for statistical and visual analysis.

**Figure 6. Adjacency Matrix for Pilot School One**

To make the SNASL Process accessible to the school librarian who had little to no experience with social network analysis, I devised a worksheet to guide participants through the process while teaching basic social network concepts. As a means of structuring the process and aiding school librarians in linking social network concepts to daily practice, I placed the focus on individual positions in the network and classifying individuals into four categories: central connectors, peripheral people, information brokers, and boundary spanners. The worksheet, featured in the Appendix, also included instructions for how to use UCINET to generate statistical measures, manipulate network maps, and apply attribute maps to network visualizations. The worksheet did not include instructions for how to collect network data, transfer data to an adjacency matrix for upload to UCINET, or install UCINET 6 for Windows. I performed these steps for the school librarians. For the school librarian who wishes to engage independently in the SNASL Process, the worksheet contains important procedural information. I did not test the worksheet as part of the participatory analysis in this study.

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the data. My role was intentionally minimal to enable the school librarian to engage in the process without interference.

I subsequently transcribed and coded the interviews from the participatory analysis. I initially coded interview transcripts, and then read again to validate and identify supportive data for each identified theme. Interview transcriptions and field notes were gathered for initial coding. Using these initial categories, transcripts were read again and analyzed to validate codes and identify supportive data for each identified theme. Three themes were identified during this analysis: identifying role positions, producing generative insight, and enabling the potential for strategic improvement of collaboration.

**Limitations.** As a result of the participatory analysis with Pilot School One, I revised and restructured the SNASL Process Worksheet (featured in the Appendix) in three substantial ways: 1) the worksheet was now organized by role position so that a school librarian would be led to examine the statistical analysis and then the social networking diagram for one role position before moving on to examine the next one; 2) additional descriptions of each role position were added to clarify their value and purpose; 3) additional questions were added to elicit school librarian's thinking regarding the strategic value of the social network data.

To further examine whether the revised worksheet would result in more generative insight and strategic responses from the school librarian in Pilot School One, a second interview was conducted. In both interviews, the school librarian was able to identify individuals in specific role positions, but in the second one she moved beyond identification to strategy for improving teacher collaboration. Additionally, the researcher encountered technical difficulties with the attribute maps and was unable to explore these with the school librarian in Pilot School One during the first participatory analysis section. However, results from this section led to me to revise the SNASL Process Worksheet and use a new worksheet in the follow up interview with the Pilot School One school librarian.

## Findings

### **Individual Network Positions**

During participatory analysis, school librarians walked through the SNASL Process worksheet, which guided them throughout identification and analysis of four types of network positions: information broker, central connector, boundary spanner, and peripheral person.

**Information Broker.** Information brokers sit on the shortest path between the remainder of the network. They are likely to have a large number of ties between disconnected actors, serving as the bridge between individuals. Therefore, information brokers disproportionately affect information flow and can be leveraged to promote connectivity within the network (Cross & Parker, 2004).

School librarian participants identified information brokers as "people I want to have stronger connections with because they are influential." In Pilot School One, the school librarian identified Sped D (one of the special education teachers in the school) as an information broker due to his or her position in the network as connecting together various subgroups. The school librarian noted "*I need to be in Sped D's business so I can say hey, do you know what's going on,*" confirming her understanding of the role of the information broker's ability to increase social capital. By connecting with Sped D, she also gained access to his or her human capital, knowledge, skills, and abilities. In Pilot School Two, the school librarian remarked that:

*[I]t would help me to pinpoint the people I should be contacting and seeing if I can get them to collaborate with me, because they are going to have influence over the people with whom*

*they are interacting. And there's that possibility that they'll say something about oh what a great lesson we had and another might pipe in and say oh, I'd like to try that. What's the possibility you and I can sit down together when you get a chance?*

Her statement acknowledged that information brokers are connected to a diverse group of people in the network and that by working with them, she is increasing her presence throughout the whole building. Since information brokers are well connected, there is a higher possibility that other teachers will see or hear about successful collaborations that occur with the information brokers. The school librarian was able to take this information and apply it to a collaborative strategy - focusing attention on collaborating with information brokers to take advantage of her role position.

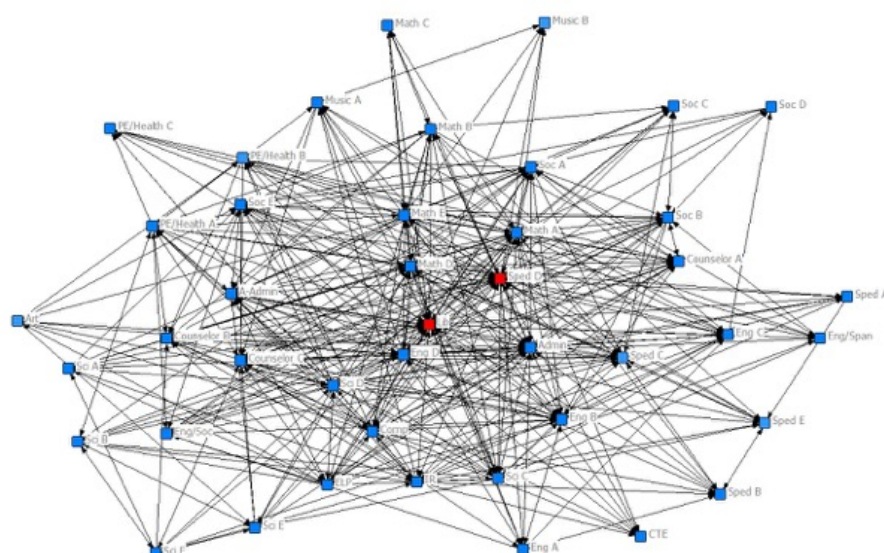
**Central Connector.** A central connector is highly sought after and therefore has greater access to information and social support from the network. These individuals tend to be centrally located in the network and as such, have a greater ability to leverage resources compared to more peripheral individuals (Tsai, 2001). However, large numbers of direct ties can also drain an individual's resources because they require time and effort to maintain (Balkundi & Harrison, 2006). Furthermore, the social norms present within the group may constrain an individual's behavior defined by those ties (Burt, 1995). Therefore, a central connector may be perceived as an expert in the system, but they may also be a bottleneck that is holding up the flow of resources and information. The school librarian in Pilot School Two noted that she could

*...also use this analysis to identify the people who are perceived experts / authority / bottlenecks because they could help route people to the library when appropriate. Identify who those individuals are could give insight into what they were doing to make them seen as attractive to other faculty and I could emulate or expand upon that.*

She was able to identify the usefulness of the data to “identify the people who are perceived experts/ authority/bottlenecks” and use this information to strategize her approaches to collaboration to “emulate or 8” on what the central connectors were doing to “make them seem as attractive to other faculty.” Although this approach was different than the one taken by the school librarian in Pilot School One, who identified individuals she could reach out to in order to benefit from their network connections, it is no better or worse. In both situations, the social network analysis enables the school librarian to move from a unplanned approach that focused on existing collaborative relationships to a targeted and strategic approach that enabled the development of new collaborative relationships.

This strategy also allowed the school librarian from Pilot School Two to capitalize on the human capital of the central connector. To “emulate or expand” on what a central connector does is to engage with and learn from that individual, accessing their human capital and utilizing it to increase one's own.

The power of visualizing the network via a social network map was confirmed when using the graph theoretical layout to view central connectors in Pilot School One mapped by geodesic distance, as shown in Figure 7 in which nodes are organized by graph theoretical layout and central connectors are coded in red.



**Figure 7. Social Network Diagram of Central Connectors in Pilot School One**

Upon viewing Figure 7, the school librarian made a statement that “the ones in the center, they are clustered that way because they have stronger, more connections” and then noted that the map was “visually more reflective.” By visualizing the centrality of individual network members in this way, the school librarian was able to see the relative capacity of each member of the network to quickly and effectively communicate information:

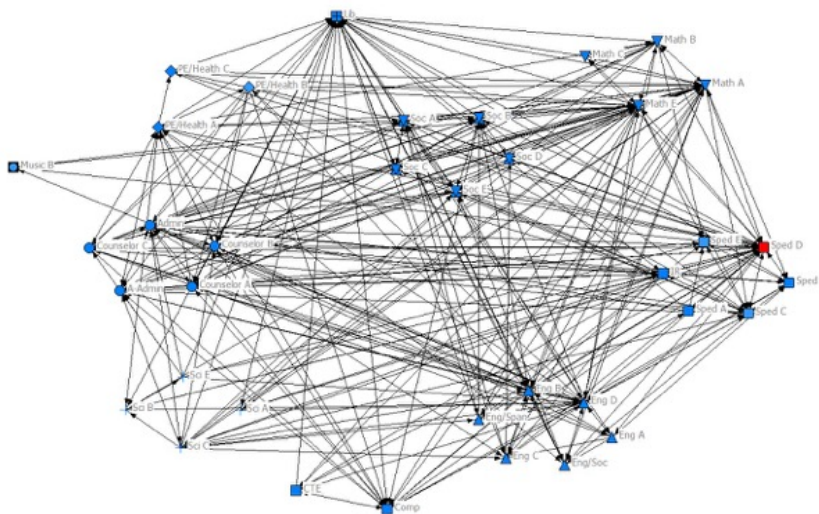
*Sped D, which also has one of the lowest [geodesic averages]. It's interesting. Do you see... am I seeing right? English D. English D also was ranked as an information broker. But it's interesting because the school librarian and English D have more influence than the admin does... That's cool. Not that it's influence, but it's more power in the structure. I think it's just information not power... Like in the ability to share information and connect and collaborate there is a lot.*

Visualizing the social network data in various configurations enabled her to see the actors with the most ability to share information throughout the network. As with the information brokers, she was initially surprised that the administration was not more central. The visualization shifted her preconceptions about the nature of power. She acknowledged that, although the principal was the authority in the building, he or she may not have the influence necessary to quickly disseminate information or connect people throughout the building.

**Boundary Spanner.** Information within subgroups is often redundant, since people closely connected to one another tend to have access to the same resources, and research has shown that people rely on previously established communication channels (Hansen, 1999). A network with distributed expertise and many weak ties has little redundancy. When structural gaps are bridged, the additional flow of information ensures that both subgroups have access to the information flows within the subgroups. The more structural gaps spanned, the richer the information within the network. Thus, it is important that brokers exist to bridge structural gaps and enable new knowledge to flow into existing subgroups. The broker, often referred to as a boundary spanner, spans the hole and serves in this role (Cross & Parker, 2004). School librarians can make a point to become this individual by forming the necessary connections, and thus becoming more central to the information flow in the school building.

Figure 8 depicts a network map that shows how Sped D has connections with various academic subunits within the school. For visual clarity, Sped D has been color-coded red and each subject area subgroup has been coded a different shape. Sped D, similar to central connectors and information brokers can help spread information across the network. However, unlike central

connectors and information brokers, boundary spanners have more control within the network, because they are not constrained by the norms of a particular subgroup. This means they are likely to have more influence than other members of the network.



**Figure 8. Ego Network of Sped D in Pilot School One**

Figure 8 is organized by subject area. Each subject area is coded a different shape. Sped D is red. Upon examining the map in NetDraw depicted in Figure 8, the school librarian in Pilot School One noted that Sped D and Library were potential boundary spanners and that although the Admin had connections with various departments they were not as robust as the connections present within the ego network of Sped D or Library. This triggered her to reflect on the role of the admin and why this might be the case:

*and I wonder if that's because in our building so many of us connect with each that we don't have to go through the admin to get to somebody. In other schools, you may have to run other networks, you may have to go through that power broker in order to get to others, but here people aren't afraid to just walk across the hall or go downstairs or go... reach out... because they are aware of who has information that they need. It's like, who knows how to use the printer, how to do this, I need to connect with the Z4 team [a professional learning team in the building], all these things. It's like the admin, are go-tos, but maybe not for all the day to day business. Where our boundary spanners are the day-to-day business of getting stuff done. We don't have to jump through hi to get to somebody else. We just go get it. I know who's gonna know...*

She went on to differentiate the role of the information broker and the boundary spanner:

*I think you need like the information brokers. They get the information out. But these boundary spanners. These are the others you can get to those you are not collaborating with. It seems like those are the ones you want to target if you want to build more connections and stronger connections. Those are the people you want to connect with. Cause your information brokers are going to be able to share information and all that, but the boundary spanners are the ones that are going to have a better jump to other people, they'll get them, bring them in, you know. It's like get those outliers and bring them in.*

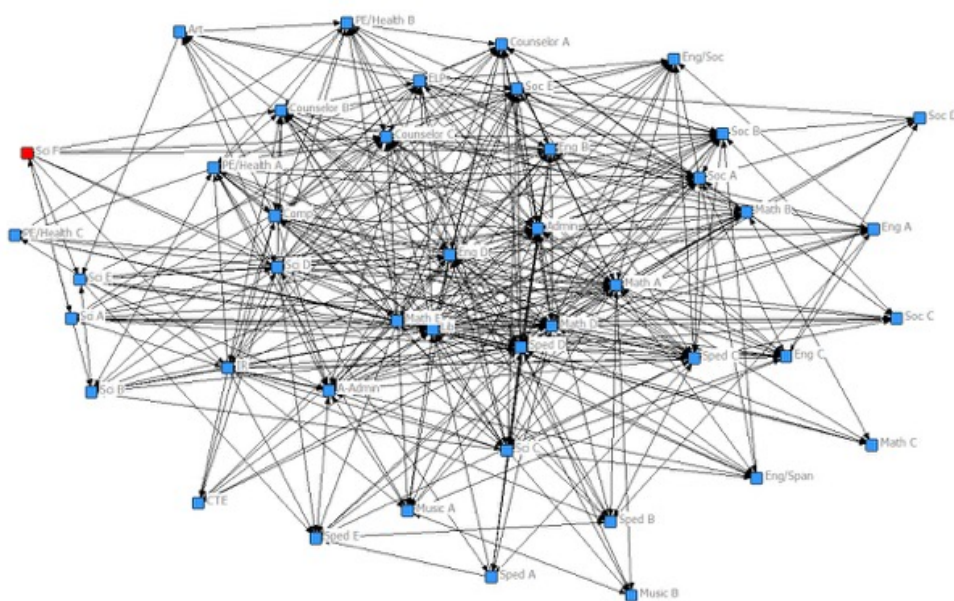
These observations confirmed her understanding of the role boundary spanners play in the social network of the school and demonstrated her ability to use the information to improve collaboration by forming relevant strategy.

### **Peripheral People**

Peripheral people operate on the perimeter of the social network. They have few ties to the other actors in the network, measured by ego network size (Borgatti et al., 2002; Cross & Parker, 2004). These individuals may have underutilized skills, expertise, and unique perspectives that are not being leveraged by the school.

Individuals may be on the periphery because they wish to be there or because they are not sure how to work their way inside (Cross & Parker, 2004). Identifying these individuals can allow school librarians to form mentoring relationships, introduce them to others, or get them involved in bigger projects. However, some individuals are on the periphery by choice. Pushing them to be involved may reduce their morale or reduce their own work effectiveness. It is important to get to know people to understand these distinctions. For example, if a woodworking teacher is too busy helping other teachers with woodworking projects outside of his or her classes, he or she may not have time for their own professional development. Regardless, enabling peripheral people to build more network ties increases the social capital of the entire organization, as their knowledge and resources become more easily accessible by other teachers.

In both pilot schools, school librarians were able to identify those on the periphery. The visualization, as seen in Figure 9, a graph theoretical layout by geodesic distance. Note that Science F, a periphery person, is in red for visual clarity.



**Figure 9. Social Network Map of Pilot School One**

In particular, the connections illustrated in Figure 9 allowed them to see individuals that were on the edges of the network and had fewer connections.

*I want to see...less of these outliers...When I look at all these arrows I like seeing like almost a black circle [referring to the arrows being so tightly connected that they form a black band around the node] around some of these people; you know, cause it means they are connecting everywhere, but then I see this [points to Science F] and there's not a lot coming in and I don't see a lot coming out. You know, like, look at this right here. That's not cool.*



Both school librarians also recognized that some people are on the periphery by choice and may not wish to be further involved in the network, or may need space to do their jobs effectively. *“Well, if you look at the science, this music, with the ones and the twos, that these people don’t feel ostracized, or don’t feel I’m not getting everything I need, but it’s more of a content specific I’m good, life’s good...”* Their observations indicated that the school librarians recognized that some individuals, who possess a great deal of human capital, might still have limited access to social capital. Identification of individuals in these role positions allowed them to make a choice about how to proceed and where to focus their energies.

### ***The Potential for Strategic Improvement of Collaboration through Generative Insight***

Mapping the collaborative relationships of actors in the network and viewing and manipulating the social network maps enabled the school librarians in each pilot school to notice things of which they were not previously aware. One of the school librarians described the differences between her current approach and using social network analysis to improve collaboration when she said

*...you’re just scatter plotting everywhere... build it and they will come; but this will be targeted. It’s targeted and intentional when you have the data. You’re like, okay, look at this. It’s very clear that this is where I need to go, this is where I need to go.*

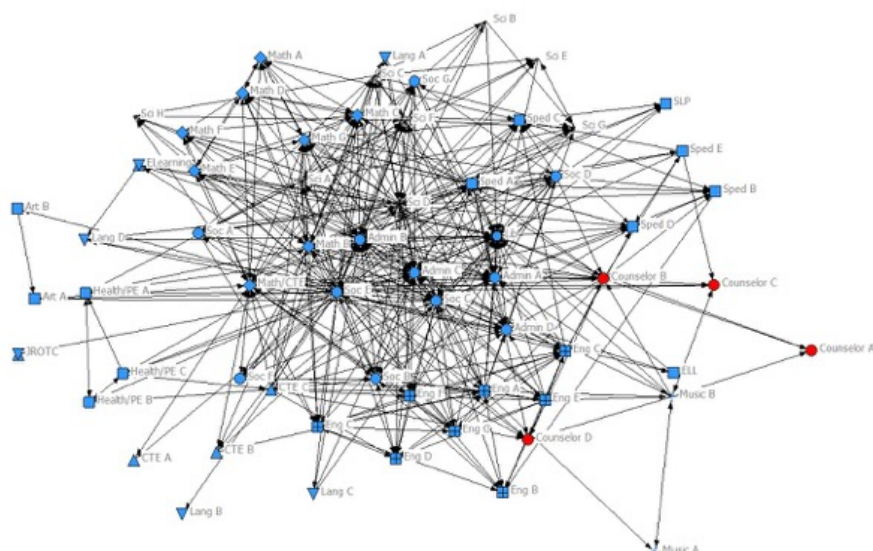
Since each school librarian was new to their school site (less than two years), they were still learning about the social relationships between the staff and their individual needs and preferences. The ability to see those relationships mapped into a diagram, and then connect that information to ideas about the flow of resources and influence, provided a tool that allowed the school librarians to strategize to improve collaboration.

*Knowing who has the most influence, especially since I am still new - 2 years isn’t long - it would help me to pinpoint the people I should be contacting and seeing if I can get them to collaborate with me, because they are going to have influence over the people with whom they are interacting.*

The school librarian recognized that these data would allow her to “pinpoint” the people she should reach out to *“get them to collaborate.”* By working together with those that have the most influence in the network, she gained access to their human capital and increased the potential for others to learn about her collaborative projects to replicate that experience with their own classes.

Similarly, she recognized that she *“could also use this analysis to identify the people who are perceived experts / authority / bottlenecks because they could help route people to the library when appropriate.”* By targeting her efforts at those with the most capacity to reach others in the network, she could increase her chances of convincing others to collaborate with her and use the library.

These types of insights ranged from broad concepts about the nature of collaboration and how the SNASL Process could be used to improve overall collaboration, to observations about specific individuals. In Pilot School Two, the school librarian observed one subgroup when she noted *“Counselors had low numbers but they are involved with every student, but you would think they are, would be involved with every teacher, but they are isolated.”* The visualization of the network enabled the school librarian to see that the counselors were connected to each other but isolated from the rest of the network; they had few connections to other teachers. Figure 10 depicts the map organized by graph theoretical layout by geodesic distance. For visual clarity, nodes are shaped by subject area and counselors are in red.



**Figure 10. Social Network Map of Pilot School One with Counselors**

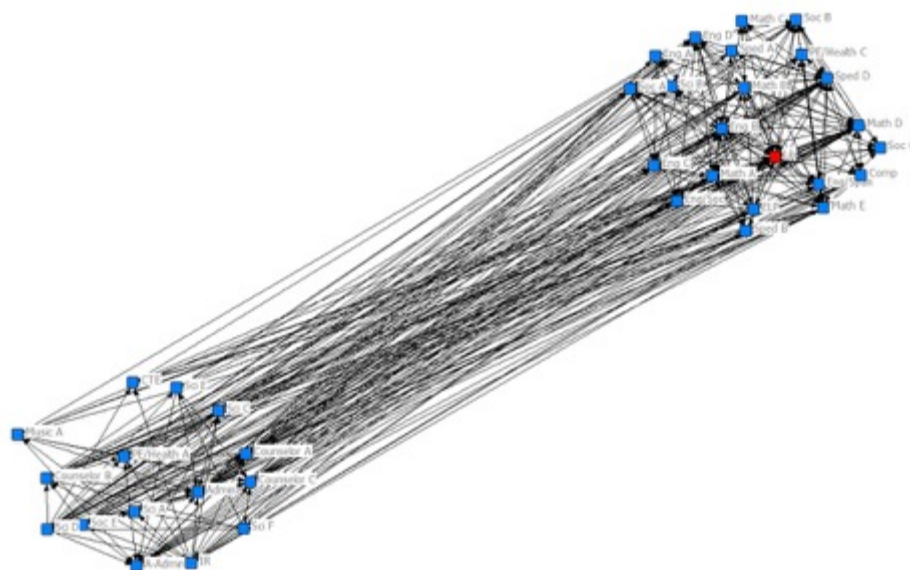
As Figure 10 shows, By identifying those in the periphery like the school counselors, the school librarians gained the ability to make a strategic choice. She could then speak the individuals on the periphery to determine why they were there and whether it was a matter of choice. She could then choose to aid the periphery people in becoming more collaborative and thus increase the social capital of the entire organization, or she could choose to spend her efforts elsewhere. Prior to the identification, however, the school librarians were unable to make that choice because they did not have the information to do so. The SNASL Process enabled them to be in a position where strategic choices are possible.

### **Confirming and Modifying Preconceptions**

The examination of the social network diagrams also resulted in confirmation or modification of school librarians' preconceptions of their own practice. For example, one of the school librarians mentioned a disconnect between two sections of her building.

*I always feel too we have this disparity between upstairs downstairs. I feel like I connect more with people upstairs because they're upstairs where the library is and I have fewer connections with people downstairs because they're all the way downstairs, they are at the other end of the building.*

Based on this comment, the school librarian and I generated an ego-level social network diagram for the school librarian using a layout that mapped actors by location in the building (Figure 10). The school librarian, who feared that she spent too much time with teachers that were physically closer to her in the building, noted, "it's not so bad. It's like okay... there's still some connections." By viewing the network map in this configuration, she was able to see the proportion of connections she had with teachers upstairs (where the library is located) and downstairs. Her perception was that upstairs connections would be much more robust, but in reality, the difference was less than she believed. Furthermore, by knowing who she was not connected to, and who indicated they were not connected to her, she could begin to build relationships with those individuals and change faculty perceptions of collaboration. The visualization of the social network changed her preconceptions. Figure 11 depicts the map with nodes are categorized by location in the building: the lower left are staff that work primarily downstairs; the upper right are staff that work primarily upstairs; and the teacher librarian node is red.



**Figure 11. Ego Social Network Map of Teacher Librarian in Pilot School One.**

Having data that demonstrate the collaborative connections present in the building and visualizing those data with social networking maps enabled both school librarians to move beyond “scatter plotting everywhere” and a “build it and they will come approach” to a more “targeted and intentional approach.” By seeing where the connections existed and where they did not, the school librarian participants were able to strategize potential approaches to improve collaboration in a way they had not previously accomplished.

Unlike a report conducted by an external researcher where the internal employee is looking only at predefined network diagrams, the school librarians using the SNASL Process had full control of the social network analysis software. The school librarians using SNASL were able to shift the organization of the visualization, target specific individuals for examination using statistical analysis, or ask specific questions based on preconceptions or curiosity, and then use the social network visualizations to answer them.

While engaging in the process, the school librarians recognized their own agency in manipulating the social network diagrams within UCINET. During the participatory analysis sections of the research, they often choose a specific individual or subject area whose ego or subgroup network they wished to explore. The ability to make these sorts of choices and see the various connections within and between departments was exciting to the participants who acknowledge the potential of this type of insight. As one participant noted,

*Look at each department to see where reciprocal connections exist and do not exist to know who to reach out to within a specific department. Add the school librarian in to the analysis to see where the connections exist. By looking at the reciprocal relationships, the participants saw the potential for inserting some kind of activity where two individuals were collaborating with the help of a facilitator. That's really exciting.*

The themes that emerged during this research, i.e., the role of network positions and the potential for strategic improvement of collaboration through generative insight, can be exciting not only to the school librarian who wishes to evaluate and improve collaboration in his or her school, but to school leaders who recognize the value of collaboration and its ability to lead to improved school achievement.

### **Considerations for this Study**



In this study, I only examined the potential of social network analysis as a tool for school librarians in secondary schools. Since the school district involved in the research has certified school librarians only at the secondary level, I included no data from elementary schools. In the United States, elementary schools often have different collaborative structures: they more likely to focus on grade level teams rather than subject area, and school librarians are more likely to work with students on a fixed schedule. Therefore, additional research is needed to determine the impact of social network analysis, and specifically, the SNASL Process, in elementary schools.

I was responsible for data collection and generation of the adjacency matrix used by UCINET to generate statistical analysis and social network diagrams. Additionally, I facilitated the participatory analysis such that was minimal, however, I did offer explanations and technical assistance to the school librarians. Thus, without a facilitator's presence a school librarian may experience differing results when engaging in the SNASL Process. Further pilot testing and social network analysis research can incorporate additional school settings and levels of school librarian experience to further validate these findings.

## Conclusion

The findings in this study confirm that social network analysis has the potential to generate transformative insight and lead to systematic collaboration built upon concrete information and a holistic perspective of the collaborative environment of the school. The methodology can be particularly useful for those school librarians that are new to their particular school.

Drawing a social network map allows the school librarian to visualize the network of their school and see the interactions between colleagues. Once key players and structural holes have been identified, the school librarian can think strategically about building relationships and increasing collaboration. This allows the school librarian to think purposefully about where they fit into the social network of the building and how to make changes to that role if desired. By acknowledging the data, and devising a plan of action, the school librarian can become an information broker and connect people and departments together, thereby placing themselves in a position of influence and a bridge to greater collaborative networks. By examining one's position in the social network of the school, the school librarian can uncover and then act to resolve many kinds of personal and system-wide weaknesses.

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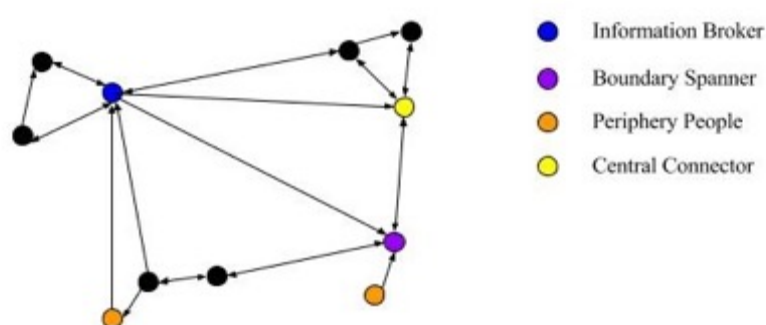
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## Appendix. Social Network Analysis for School Librarians Worksheet

### Introduction

There are multiple ways to analyze a social network. This process uses some of the most common methods to get a broad picture of the network. This will by no means be comprehensive and will not look at all the possible tools, because some are not relevant to our purpose and some are overly complex for the time and goals of the examination.



**Figure A.1: Visualization of four types of individuals in networks**

There are four types of individuals in networks:

- Information Brokers - People who sit on the shortest path between others. These people can help disseminate information throughout the network.
- Central Connectors - These people typically have a high in-degree and a low out-degree. This can be viewed in two ways. One is that they are perceived as an expert and the other is that they are a bottleneck of information that could be better diversified.
- Boundary Spanners - Connect one department with other departments. They have ties to and from multiple departments and are usually the only individual connecting those departments.
- Peripheral People - On the edges of the network with few connections; they might need help getting better connected or need space to operate on the fringes.

For each network position, it makes sense to examine the statistical data and then look at the social network diagrams. This will enable you to identify individuals to focus on when looking at the visualizations and also reduce bias, since decisions on who to examine are based on quantitative data.

### Information Brokers

Information brokers have a large number of outgoing ties; they are always sharing information and resources. Unlike boundary spanners, that tie together specific subgroups, or central connectors, that have lots of authority, information brokers are just overall well connected. **School librarians**

that wish to get information out quickly and to a wide audience would do well to target information brokers as part of their marketing strategy.

In UCINET, run the report Network > EgoNet > Basic Measures: This gives you statistics about the network of each individual actor. Look at the columns labeled broker and nbroker. Broker is the number of pairs that are not directly connected. In other words, this actor bridges the gap between these pairs. Normalized broker (nbroker) is the broker divided by the number of pair; or the percent of pair where the actor serves as the broker. The higher the nbroker, the more influential the actor is in their network.

Q1: Who would you identify as the most influential actors in the network? Why? How could you use this information to help improve collaboration?

In NetDraw, open the data matrix and load the attribute file. Once this is open, it can stay open throughout the remainder of the exploration. Click on Layout > Categorize by Attribute > Subject. This will organize the visualization by subject area so that teachers within the same subject area are clustered together. Find the information brokers you identified in Q1.

Q2. Who else do they connect to? Do they connect diverse individuals? Do their ties appear to be mostly one-way or mostly reciprocal? How could you use this information to help improve collaboration?

### **Boundary Spanners**

Boundary spanners connect multiple subgroups within a school. The math department and art department may not work together very often, but if there is a teacher in the history department that works heavily with both math and art he is serving as a boundary spanner. The groups may not work together more frequently as a result of his presence, but he can transfer information between the groups easily. A **school librarian** may wish to seek out a boundary spanner when he or she wants entry into a specific subgroup.

In UCINET, run the report Network > EgoNetworks > Structural Holes: Use Whole Network Model. Look at the column labeled Constraint. Constraint reflects how many of the actor's connections are connected to one another. Visualize constraint as power in their network. The principle is that if a network is tightly connected than the influence of an the individual member is constrained; they have less impact on the whole network if everyone has equal access to all members of the network. Thus, the lower the number here, the less constrained and the more potential impact an actor has on his or her network.

Q1. Which actors have the most impact on their network? Why? How could you use this information to help improve collaboration?

In NetDraw, click on Ego and check one of the boundary spanners you wish to examine. This will show the ego network of this individual. In other words, who is seeking this person for information and who does this person go to for information within your school network. Repeat this for each boundary spanner.

Q2. Does this change your perceptions of the role of these individuals in the school's network? Who else do they connect to? Do they connect disparate subject areas? What subject areas do they How could you use this information to improve collaboration?

## **Central Connectors**

Within a school, the principal is the authority. However, we all know other teachers and support staff we go to besides the principal when we need something done. Central connectors are often described as having a great deal of authority because many people go to them for information. Although they may not have the official authority of a principal, they often run day to day operations behind the scene, ensuring people have the resources and information they need to operate.

In UCINET, run the report Network > Cohesion > Point Connectivity. This calculates the number of nodes that would have to be removed in order for one actor to no longer be able to reach another. This should the strength or tenuousness between a particular actor's connection to the network. If the number is higher the individual has many ways to get information to the other actor. If the number is low, there are few ways channels of information flow for that actor.

Q1. Who are the central connectors in their network? How could you use this information to help improve collaboration?

In NetDraw, look at the entire network. If you're still in Ego view, click on Node and select the radio buttons to turn all inactive nodes active. Click on Layout > Graph Theoretical Layout > Geodesic Distance. This diagram maps actors so that the ones that are most central are in the center of the diagram and the ones that are most peripheral are on the edges of the diagram.

Q2. Who is at the center of the visualization? Do you see the same individuals you identified in Q1? Are you surprised at any of the positions of individuals on the map? How might this help you improve collaboration?

## **Peripheral People**

Peripheral people sit on the edges of the network. They have few connections within the network. This may be intentional - as they wish to operate independently - or it may be that they have difficulty getting involved. **School librarians** that wish to improve collaboration may wish to find out why an individual is peripheral in the network and if appropriate find a way to get them more involved.

In UCINET, run the report Network > Cohesion > Point Connectivity. This calculates the number of nodes that would have to be removed in order for one actor to no longer be able to reach another. This should the strength or tenuousness between a particular actor's connection to the network. If the number is higher the individual has many ways to get information to the other actor. If the number is low, there are few ways channels of information flow for that actor.

Q1. Which individuals have the weakest connections to the network? How could you use this information to help improve collaboration?

In NetDraw, examine the graph theoretical layout diagram again. Look for individuals on the edges of the network.

Q2. Who are on the edges of the network? Who are they connected to if anyone? How could you use this information to get them more involved?

## **Final Analysis**

Q1. Based on this analysis are there particular people you might reach out to that you hadn't before? Why?

Q2. What's your overall impression of the usefulness of this data and analysis approach? Do you see yourself doing this again? How often? Who would you survey? All staff, just certified, etc.?

Q3. Play around with the map by moving nodes around, changing the layout, or applying filters. What do you notice when you make these changes? Don't worry if something appears lost or awry; you can always close the NetDraw window and reopen the data set.