

Network Effectiveness in Context

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Abstract

Increasingly, scholars and practitioners are interested in evaluating the effectiveness of cross-sector networks. The authors use a configuration approach to the study of network effectiveness. This research is a mixed-method study of 26 education networks in the United States. The researchers measure network effectiveness by comparing 4th-grade literacy, 8th-grade literacy, and high-school graduation rates. They compare these scores with all school districts in the state using interrupted time series or parametric difference-in-differences approaches. Then, drawing from qualitative data from interviews and archives, they investigate the network governance, environmental characteristics, and theories of change associated with greater student achievement. Using fuzzyset qualitative comparative analysis, they find three configurations associated with network effectiveness. One configuration associated with network effectiveness is to combine learning and systems alignment theories of change. A second configuration combines decentralized governance with a project theory of change. The final configuration combines decentralized governance, learning theory of change, high community poverty, and larger network size. The results support the configurational approach, which suggests multiple configurations of factors in combination may result in network effectiveness.

Introduction

Cross-sector networks respond to complex problems that no one organization can address alone (Isett et al., 2011; Weber & Khademian, 2008). The promise of cross-sector networks is that the newfound interdependencies among organizations will generate better outcomes than independent action from the same organizations. This promise is aspirational since we lack concrete evidence that cross-sector networks can and do create system-level outcomes that are better than what would have occurred through independent action (Shumate & Cooper, 2021).

The goal of this research is to identify the combination of factors associated with community-level effectiveness. Community-level effectiveness describes the effects of the network within a geography (e.g., improvement in health or educational outcomes among individuals in a geographically bounded area) (Nederhand, 2020). To fulfill this purpose, we draw on the configurational approach to networks. Specifically, we conduct a comparative analysis of 13 matched pairs of networks in the United States focused on improving local educational outcomes. We investigate which networks are associated with greater gains in an index of educational outcomes compared to other demographically similar communities.

This study makes three key contributions to the research on network effectiveness. First, this study is the first to examine network effectiveness as improvements above what would be expected based on the general trend in outcomes among other communities. We measure network effectiveness as deviations from the educational trend lines within the state. Second, this study introduces a new concept, network theory of change, to explain how networks use learning-based mechanisms and systems-alignment activities to affect change at the community level. Third, we situate this study as a response to Turrini et al.'s (2010) integrated framework that suggests that network effectiveness is influenced by a combination of network structural,

functioning, and contextual characteristics. We combine theories from structure, context, process, and functioning (Cristofoli & Macciò, 2018) to determine the combination of factors associated with network effectiveness. Specifically, we focus on network size, centralized governance, and community poverty alongside theories of change as factors that influence network effectiveness.

This article is organized as follows. First, we review the literature on network effectiveness, paying particular attention to configurational approaches. Then we introduce the network's theories of change framework we add to this work. Next, we describe the mixed method approach we use to conduct the study. We describe the three configurations we find that are associated with network effectiveness. Finally, we discuss the implications of this research for future research on network effectiveness.

Literature Review

Collaborative networks are “collections of governmental agencies, nonprofits, and for-profits that work together to provide a public good or service when a single public agency is unable to create the good or service on its own and/or the private sector is unable or unwilling to provide the goods or services in the desired quantities” (Isett et al., 2011, p.1158). In doing so, they draw attention to the network as a single unit oriented around a purpose, not the sum of its organizational parts (Carboni et al., 2019), and suggest implications for network effectiveness.

Network Effectiveness

Networks are complex to evaluate (Ngamassi et al., 2014), and researchers have argued that perceptions of effectiveness vary among the network's stakeholders or the sectors involved in the network (Provan et al., 2007). Cross-sector networks are more consistently evaluated against progress in that issue domain. In other words, networks should be evaluated in terms of

the benefits they generate – or harms they reduce – for local populations. As stated by Provan and Milward (2001), “community-based networks must be judged by the contribution they make to the communities they are trying to serve” (p. 416).

In addition to the community, network effectiveness can be evaluated at the level of the network itself or its organizational members (Provan & Milward, 2001). Network-level successes include the ability of the network to function as a holistic unit through membership growth and commitment, effective and unduplicated provision of services, and the creation of a network administrative organization. Member organizations in a network evaluate its effectiveness based on their organization’s improved access to resources, increased legitimacy, reduced costs, and a greater variety of services offered to clients. In comparison, community-level effectiveness is measured through the actual reformation of the issue through policy wins, reduced magnitude and spread of the issue, and increased numbers of community members served (Provan & Milward, 2001). Taking these into consideration, Turrini et al. (2010) defined network effectiveness as the “effects, outcome, impacts and benefits that are produced by the network as a whole and that can accrue to more than just the single member organizations in terms of increasing efficiency, client satisfaction, increased legitimacy, resource acquisition, and reduced costs” (p. 529).

Due to the complexity in gathering and operationalizing outcome data, evaluating networks against their community-level outcomes has been done in only a handful of studies (Hanberger et al., 2016; Provan & Milward, 1995; Raab et al., 2015; Verweij et al., 2013; Wang, 2016), with some studies focusing on *perceptions* of network success (Chen, 2010; Lemieux-Charles et al., 2005). Although these studies have contributed to a general understanding of

network operations and outcomes, they share some limitations, which we address in this research.

For example, in their seminal study on network effectiveness, Provan and Milward (1995) studied client well-being in four mental health networks in four cities in distinct American states. Although the cities were matched, contextually, in size, and across varying levels of resource munificence, they were not compared with similar communities in the same state and thus failed to demonstrate how the networks fared against otherwise comparable state-level interventions and policies. Hanberger et al. (2016) conducted a similar study of client well-being in the care of unaccompanied and separated children in one municipality in Sweden. Again, in the absence of a comparison in a matched community, the study is biased towards assuming that client well-being is attributed to the network's efforts alone.

A few studies with larger samples of networks attempted to correct these shortfalls. For instance, Verweij et al. (2013) studied 14 Dutch spatial planning projects. Still, the study focused on stakeholder involvement and network management and failed to account for regional contextual factors that could have influenced outcomes. Raab et al. (2015) studied an even larger sample of 39 crime-prevention networks in the Netherlands covering a wider political area; however, this study also omitted contextual regional and socio-economic factors. Moreover, most effectiveness studies assume that networks are an effective solution or a panacea to a complex problem (Koontz & Thomas, 2006; Meier et al., 2006) and gather cross-sectional data, which limits testing the impact of the network in the community over time and against other public interventions.

This research draws from the configurational approach to network effectiveness (see Shumate & Cooper, 2021 for a summary). Turrini et al. (2010) describe three main categories of

factors that influence effectiveness in a network: external contextual factors (e.g., resource munificence), functioning (e.g., management in the network), and structural characteristics (e.g., governance and centralization of collaboration processes). Douglas et al. (2020, p. 639) point out that “there is a gap in the literature to have an integrated understanding of interactions and causal interdependence” between all conditions that would influence network effectiveness. We suggest that network effectiveness is not derived from any of these factors alone but rather influenced by combinations of factors within the broader categories. This approach allows scholars to view multiple paths to an outcome allowing for variations in case conditions (Shumate & Cooper, 2021). A few of the studies mentioned above have used a configurational approach to studying network effectiveness (Cristofoli & Markovic, 2016; Raab et al., 2015; Verweij et al., 2013), but they have not accounted for external and internal determinants as outlined by Turrini et al. (2010). Using Turrini’s framework and a configurational approach to understanding network effectiveness, this study suggests combinations of network characteristics are necessary to achieve effective community-level outcomes. In the following sections, we highlight various internal and external factors contributing to network effectiveness, including network governance, community poverty, network size, and theories of change.

Network Governance

Network governance has been a long-established measure in the literature that influences network outcomes (Cheng, 2019; Jones et al., 1997; McCabe et al., 2006). Network governance refers to “institutions and structures of authority and collaboration to allocate resources and to coordinate and control joint action across the network as a whole” (Provan & Kenis, 2008, p.231). Governance can take different forms. Three forms of network governance proposed by Provan and Kenis (2008) are commonly applied across network research. Their model of

participant governance resembles self-governance in that all network members share the responsibility of making decisions and managing partnership relations, operations, and external relationships. Lead-organization governance concentrates most of the power in one lead organization tasked with decision-making and activity coordination. Rather than relying on network participants, a network administrative organization model relies upon a separate entity to govern the network. When formally structured, the entity has its own leadership team and established policies related to enhancing network legitimacy and achieving collective goals. Governance can also vary within each of these models. For example, networks governed by a single organization can resemble facilitation or direction (Wang et al., 2020).

The use of these models also suggests different outcomes for networks. Some research suggests that centralized governance produces more effectiveness. Provan and Kenis (2008) suggest that a network governed by participants may be more inefficient due to the shared power among participants. Past research has suggested that lead agency or network administrative organizations are more effective governance models for networks (Provan & Milward, 1995; Raab et al., 2015).

Other research has suggested that decentralized network governance has several benefits and may result in greater network effectiveness. For example, Raeymaeckers (2013) suggested that shared participant governance resulted in more integrated networks. Lagendijk et al. (2020) found that network governance that emphasizes inclusive decision-making benefits younger networks, particularly in combination with mission or policy orientation. Research on community-oriented networks suggests that self-governance network models can be effective, provided that the networks are small (Wang, 2016).

Still, other studies suggest that centrally governed networks and network management is one effective combination, and an absence of centrally governed networks can still be effective if combined with formalized coordination mechanisms (Cristofoli & Markovic, 2016). Cristofoli and Markovic (2016) posit those differences may be due to the sufficiency of network resources. In places where there are few network resources, self-governed dense networks may produce the best results. In contrast, centralized governance is associated with network effectiveness when there are munificent resources and a stable environment. We next explore the role of resource munificence.

Community Poverty

The level of access a network has to resources, particularly financial resources, influences what tools can be formed to achieve network objectives. Networks require extensive resources that are both tangible and intangible. Although intangible resources – such as knowledge, skills, or partner practices (Austin & Seitanidi, 2012; Hart, 1995) – are essential to networks, studies of network effectiveness have been concerned primarily with tangible resources, especially financial resources.

Provan and Milward (1995) describe resource munificence as the availability of financial resources to the network environment. Their study of mental health networks suggested that resource munificence was a necessary but not sufficient condition for network effectiveness. Network effectiveness partly depends on adequate resources to sustain the network's activities, but resources alone do not guarantee effectiveness. Resource munificence can be measured in different ways. Previous research has described resource munificence in terms of a network's amount of public funding (Cristofoli & Markovic, 2016) or as a ratio between a network's financial, material, and personnel input and the total population in the region (Raab et al., 2015).

For networks focusing on community works, as this article does, the level of poverty could be used as an indicator for resource munificence (McKernan & Ratcliffe, 2002).

Research suggests that resource munificence leads to network effectiveness; Turrini et al.'s (2010) review includes several studies demonstrating linkages between resources and effectiveness. In the years since Provan and Milward (1995), other researchers have sought to elaborate on the role of resource munificence by linking it to other network contexts and other network factors. For example, Raab et al. (2015) highlight the importance of network structure and suggest that networks governed by lead organizations require high resource munificence to be successful. Subsequent research suggests that in different resource-munificent contexts, different network structures can be effective so long as the power structures correspond to the complexity of the network itself. Although they suggest some nuance concerning available resources and network structures, these findings still suggest the importance of available resources in the first place.

Network Size

The size of a network can influence how structures and governance mechanisms are created and developed over time. Its influence is connected to how networks leverage interorganizational capacity to achieve their stated goals and purposes (Arganoff & McGuire, 2001; Hasnain-Wynia, 2003), thus affecting network effectiveness. Smaller networks coordinate collaboration more efficiently; thus, when combined with a high level of trust and a decentralized or shared governance structure, smaller networks are more likely to succeed (Provan & Kenis, 2008). Previous research has found that smaller networks tend to rely on most partner organizations to broadly participate in many aspects of the coalition, with less task and process differentiation (Rigolon & Gibson, 2021). In larger networks, the effort placed in

managing the relationships goes beyond specific organizations and could lead to chaos and ineffectiveness (Provan & Milward 1995). Therefore, scholars have been calling for central governance in managing successful larger networks.

Furthermore, larger networks tend to develop multilayered management practices with action teams and data teams. Centralized governance acts as the coordinating mechanism to ensure teams learn from one another and complement each other's work (Shumate & Cooper, 2021). Based on these results, we argue that network size and network governance play a role in network effectiveness. Larger networks may require different governance strategies than smaller networks do to be effective (Lagendijk et al., 2020).

Theory of Change

Varying definitions of what constitutes success (Turrini et al., 2010) has hampered network effectiveness research. Many of these differences are because the networks studied do different things. Raab and colleagues (Raab et al., 2015), for example, studied networks designed to reduce criminal recidivism. Provan and Milward (1995) studied networks delivering services to mentally ill patients. Wang (2016) studied community governance networks. In each case, network effectiveness was related to a different type of change or service provision. Some scholars have suggested that we return to the foundations of organizational design, focusing on task division and allocation (Kenis & Raab, 2020). Such an approach treats organizational action primarily in terms of joint production. We take a broader perspective.

Drawing from broader literature on collaboration type (Keast et al., 2007) and collective impact (Kania & Kramer, 2011), we adopt a framework put forth by Shumate and Cooper (2021) that focuses on the theory of change networks utilize to create social change. Each theory of change focuses on the *network's* actions to create outcomes rather than the type of network (e.g.,

community health, environmental, advocacy, and service delivery). Shumate and Cooper propose five theories of change: project, learning, policy, catalyst, and systems alignment.

Project mechanisms for creating social change focus on the creation and delivery of a new program or product. In this mechanism, member organizations rely on joint inputs and joint outputs. Many of the networks studied in public management have been concerned with this theory of change (see Agranoff, 2007; Carboni et al., 2019).

Learning-based mechanisms focus on improving the quality of services that organizations already employ. Communities that Care Coalitions, for example, utilize this approach. They train their network members, including government agencies, on evidence-based practices that reduce youth substance abuse and other associated behaviors. The degree to which the members learn and adopt those evidence-based practices determines the outcomes of the network (Shapiro et al., 2015).

Policy-based mechanisms focus on whether governments change policy in response to the network's efforts. Networks are effective when they create new policies or encourage the enforcement of existing policies. Such efforts have the potential to impact entire communities rather than just client populations. Emerson et al.'s (2012) work on collaborative governance demonstrates such a pathway. Their model shows how the collaboration dynamics lead to collaborative actions taken by a collaborative governance regime, impacting the entire system context.

Catalyst mechanisms refer to networks aiming to disseminate a known solution. They might catalyze partnerships between organizations to share a better way of working or create entire networks of organizations as a known solution to social problems. Effectiveness for catalyst networks relies on more organizations adopting their evidence-based practice and

producing similar results as implemented in different contexts. Shumate and Cooper (2021) describe the work of the Graduate! Network, which seeks to replicate its network model through technical assistance and workshops. Their success depends on other communities adopting its model of increasing postsecondary completion.

Finally, *system alignment* focuses on diverse network members coordinating their activities to explore gaps in service and where earlier gains are lost. Coordination does not mean creating network projects but rather working together so that existing programs and services produce better outcomes. An example of systems alignment is creating a standard kindergarten-readiness metric across schools and then distributing the results to feeder preschools. Feeder preschools can align their curriculum with the kindergarten curriculum to prepare young students for their next school.

Based on the previous research and frameworks reviewed above, network size, network governance, and community poverty are vital explanations for network effectiveness. In addition, we add the theory of change from Shumate and Cooper's (2021) framework to address the approach each network takes. In this article, networks utilized the system-alignment, learning, and project-based theories of change to create change in educational outcomes in communities. This research investigates how network governance and size, community poverty, and the network's theory of change in combination produce network effectiveness.

Method

Case Studies

This study draws from mixed-method case studies of 26 cross-sector and within-sector collaborations aimed at improving educational outcomes. These initiatives were sampled by first identifying 13 collective impact networks working on education. We then used the following

matching criteria to locate another 13 communities to be added to the sample as matched pairs: geographic (e.g., population density, coverage area, and the number of school districts or municipalities), demographic (e.g., race and poverty rate), and labor market (e.g., unemployment rate and median income). The matched networks in these communities either adhered to another network design model or were a less developed collective impact network. All networks were collective impact networks in Wisconsin and Ohio, although the matched networks were less developed. Each matched pair was from the same state to minimize differences across educational contexts (i.e., teacher unionization and outcomes measures used). Table 1 in the online supplement provides a detailed demographic comparison of communities in our sample.

The 26 networks are in 11 states.¹ They vary in size, ranging from eight member organizations to 102 organizations. These coalitions serve urban, rural, and suburban communities, and some span multiple school districts. The average founding year is 2012. These networks also have various lead agencies; 12 have federated or philanthropic agencies leading the network; six have community-based organization leaders; six leads are government agencies, and two leads are higher education organizations.

Procedures

Network leaders participated in semi-structured interviews. Interview topics included the network's history, mission statement, funding sources, strategies used to align partners, community engagement activities, and the type of data that the network collected. The first round occurred in 2018, and the second round occurred in 2020. The interviews lasted between 40 and 60 minutes. The interviews were recorded and transcribed with Temi.com. In addition, we

¹ Connecticut, Florida, Iowa, Maryland, Massachusetts, Michigan, Maine, New York, North Carolina, New York, Ohio, Wisconsin.

requested archival data, including founding documents such as Memoranda of Understanding (MoU), meeting notes, and partner rosters. Finally, we collected data from various archival data sources, including state departments of education, the American Community Survey, and the U.S. census. Each of these sources is described in the data and measures section.

Data & Measures

In addition to the data collected from the networks themselves, we also collected and analyzed analogous state-specific outcomes to gauge network effectiveness and a standardized set of controls to statistically adjust, albeit coarsely, for differences in the state and district-specific contexts. We then created an index of educational outcomes for school districts in each U.S. state where a network was located to measure network effectiveness. We examined fourth-grade and eighth-grade English language reading scores and high school graduation rates because this data was almost universally available.² For every state in which a pair of networks was located, we obtained data for each school district (and school in cases that do not use county-level districts) through the Common Core of Data (CCD) and the National Center for Education Statistics (NCES).³ This data included overall student enrollment, enrollment by race and ethnicity, student-teacher ratio, and the count of students who qualified for federally subsidized meals. This data was supplemented with data made available through individual state websites and data portals that report state and federally mandated test scores and high school graduation rates used in education accountability systems. A district-by-year panel of data was

² U.S. states differ in the types of public education data measured and publicly available at the district level. High School graduation data was not available for two Wisconsin and one North Carolina network. Fourth grade reading was not available in Massachusetts.

³ Eight of the networks in our sample focused on a sub-set of schools within a school district. Unfortunately, state data does not consistently report data at the school level. Analysis examines the whole school district if the network reported that it had schools within the district participate in the network. Every network we studied worked with public schools in their community.

created in each state, with indicators added for schools and districts designated as members of the studied networks. Measures of the share of students eligible for subsidized meals and the share that identify as Black or Hispanic/Latinx were also created. Both variables are common statistical controls and systematically captured in the federal data and tend to explain variations in social outcomes that could otherwise be misattributed to network affiliation.

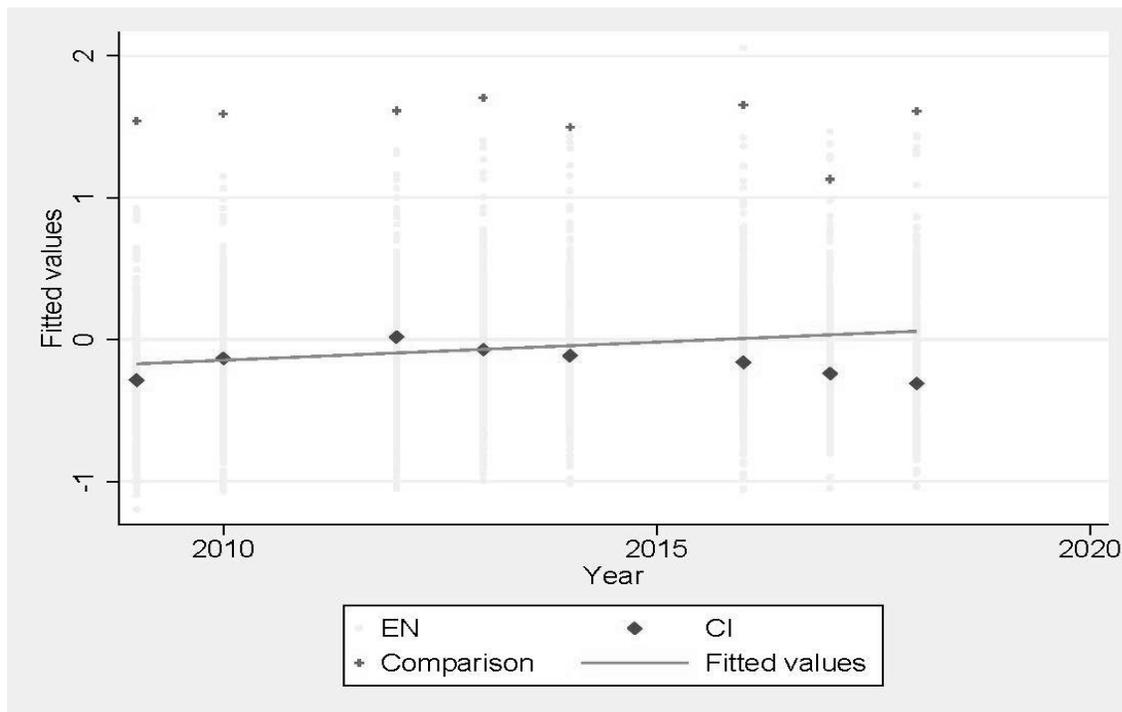
Analysis proceeded using an interrupted time series or parametric difference-in-differences approach⁴ to assess how different the observed outcomes were for districts that adopted a network structure in the period after that structure was adopted. We created 78 interrupted analyses, one for each network for each outcome metric studied. The policy interruption was the founding date of the collective impact network. All models included controls for contextual characteristics. Our analytic approach was limited to measures that were available in the same form across all contexts and the size of the dataset (e.g., the modest total number of networks). Thus, we included the share of the population that identified from minoritized backgrounds (i.e., share Black or Hispanic/Latinx), the share of the school district eligible to receive federally subsidized meals (i.e., a measure of student financial resources), and the student-teacher ratio (i.e., a measure of district financial resources).

We examined the residual score for the school districts associated with the networks (i.e., the difference between the predicted score and actual score) after allowing the relationship between network type and the outcomes to differ in the pre- and post-network adoption periods. These outcomes were relative to otherwise similar districts that had no known network affiliation. This approach allowed us to account for any district-specific linear time trends both

⁴ Data were not available in periods that predated the founding of networks in Ohio and Connecticut. As such, we used a parametric difference-in-differences approach rather than an interrupted time series for networks in these states.

before and after networks were adopted while capturing any changes in the relative performance in the post period. We could gauge the relative under- or over-performance on these outcomes by capturing the residuals associated with each period (pre and post) and across districts of differing network affiliations (see Figure 1).

Figure 1. Iowa Residuals for 8th grade English Language Arts



The figure illustrates our approach for one state and one network. The figure graphs the residuals scores for 8th grade English language reading in Iowa. The line describes the predicted values across districts in the state. The + represents the residual scores for one of the networks that we describe as having high effectiveness. Their scores are, on average, more than 1 standard deviation above the predicted trend line in the state.

Residuals were averaged across the post-founding time period. When more than one school district was affiliated with a network, we created a weighted mean residual score. The mean was weighted based on student enrollment in each school district. To calibrate the index as

an outcome, we assigned scores based on the trend in education metrics described above (see Table 2 for a summary of calibration rules). If a network had no metrics that trended positive, it was assigned a score of 0. Networks received a score of 0.3 if all three metrics were positive and consisted of residuals with a magnitude greater than .1 but less than .3, after controlling for free and reduced lunch and the percentage of Black and Latinx students. Networks received a score of 0.6 if one of the following metrics were positive and had residuals with a magnitude greater than .3 after controlling for free and reduced lunch and the percentage of Black and Latinx students. Networks received a score of 1 if two of the following metrics were positive and had residuals with magnitudes greater than .3, after controlling for free and reduced lunch and percentage of Black and Latinx students.

Table 2: Calibration criteria for network outcome and conditions

Condition/Outcome	Calibration
Network Effectiveness	<p>0 – No metrics trended positive, and residuals did not meet the magnitude values mentioned below.</p> <p>0.3 – After the network was created (or if data does not extend back that far cross-sectionally), all 3 metrics were positive and had residuals with a magnitude greater than .1 but less than .3 when controlling for free and reduced lunch, % Black, and % Latinx: 4th-grade reading (or passing), 8th-grade reading (or passing), and high school graduation.</p> <p>0.6 – After the network was created (or if data does not extend back that far cross-sectionally), 1 of the following metrics were positive and had residuals with a magnitude greater than .3 when controlling for free and reduced lunch, % Black, and % Latinx: 4th-grade reading (or passing), 8th-grade reading (or passing), and high school graduation.</p> <p>1 – After the network was created (or if data does not extend back that far cross-sectionally), 2 of the following metrics were positive and had residuals with a magnitude greater than .3 when controlling for free and reduced lunch, % Black, and % Latinx: 4th-grade reading (or passing), 8th-grade reading (or passing), and high school graduation.</p>
Community Poverty	<p>0 – Poverty rate that is below the 2016 national average of 12.7%</p> <p>1 – Poverty rate that is above the national average of 12.7%</p>
Network Size	<p>0 – 0 to 15</p> <p>0.33 – 16 to 30</p> <p>0.67 – 31 to 50</p> <p>1 – 50+</p>
Centralized Network Governance	<p>0 – Network has at least three of the following characteristics: lack of coordination in project planning or implementation, focusing on multiple agendas, loosely structured funding channels, and no strong presence of a lead agency. It was coded as -2 in magnitude coding. Networks that had one or two of the mentioned aspects was coded as -1 in magnitude coding.</p> <p>1 – Network has at least three of the mentioned characteristics: a strong presence of a lead agency, clear top-down structure, structured funding channels and mechanisms, and a common agenda it was coded as +2 in magnitude coding. If a network had one or two of the mentioned aspects, it was coded as +1 in magnitude coding.</p>

Table 2 continued

Variable	Calibration
Learning theory of change	<p>0 – Network has none of the following characteristics: similar organizations share data to compare results, everyone is learning about evidence-based practices so that they can improve their programs, teach methods like two-gen or parent engagement or equity to partners so that they will have better programs and services, action teams or working groups of organizations trying to learn best practices or pilot a project that they are all going to do if it works, organizations learn to improve their programs and services independent of the work of other organizations.</p> <p>1 – Network has all the characteristics mentioned above</p>
Systems-alignment theory of change	<p>0 – Network has none of the following characteristics: organizations layer their programs and services to produce better outcomes for shared clients, client-centered model of working together, a robust data system that is used to identify gaps in services and leaky pipelines</p> <p>1 – Network has all the characteristics mentioned above</p>

Network Governance. Network governance was measured as a categorical variable: centralized and decentralized. We conducted interviews with network leads to capture network governance, asking questions about history, mission statements, funding sources, partner alignment strategies, data collection strategies, and community engagement practices. We relied on magnitude coding for our coding choices, recommended by Saldaña (2013). For all 26 networks, we coded network governance on a scale with a range of -2 to 2 (See Table 2). A network was coded as 2 (centralized governance) if it had at least three of the following aspects: a strong presence of a lead agency, a clear top-down structure, structured funding channels and mechanisms, and a common agenda. If a network had one or two of the mentioned aspects, it was coded as 1 (somewhat centralized governance). All networks with 2 or 1 in magnitude coding were coded as having centralized governance (1). If a network had at least three aspects: lack of coordination in project planning or implementation, focusing on multiple agendas, loosely structured funding channels, and no strong presence of a lead agency, it was coded as -2 (decentralized governance). Networks with one or two of the mentioned aspects were coded as -1 (somewhat decentralized governance). All networks that had -2 or -1 were coded as decentralized governance (0).

Community Poverty (Resource Munificence). Resource munificence measures the extent to which a network's environment has a high level of financial resources or financial capacity (Provan & Milward, 1995). We collected community poverty rates in 2016 for all 26 networks from the United States Census Bureau. In this study, networks with a community poverty rate below the official 2016 rate of 12.7% were coded as having more resources (0). Networks with a poverty rate above 12.7% were coded as having fewer resources (1).

Network Size. Network size measures the number of organizational members in one network. In this study, networks between 0-15 partners were coded as 0. Networks with 16 to 30 partners were coded as 0.33. Networks with 31 to 50 partners were coded as 0.67. Networks with 51 or more partners were coded as 1.

Learning Theory of Change. In this research, networks primarily embraced the project, learning, and systems-alignment theories of change. There were insufficient cases to examine the other theories of change. Networks that use a learning theory of change view collaboration as a tool to improve programs and services at the organizational and network levels through information sharing. The learning theory of change assumes that a network is deeply engaged in quality improvement by sharing best practices and strategies (Shumate & Cooper, 2021). Based on interviews and archival data, networks that were coded as having a learning theory of change (1) had some of the following characteristics: similar organizations share data to compare results, everyone is learning about evidence-based practices so that they can improve their programs, teach methods like two-gen or parent engagement or equity to partners so that they will have better programs and services, action teams or working groups of organizations trying to learn best practices or pilot a project that they are all going to do if it works, organizations learn to improve their programs and services independent of the work of other organizations. Networks with none of the above characteristics were not coded as having a learning theory of change (0).

Systems Alignment Theory of Change. Networks with a systems-alignment theory of change emphasize the need for synergy among organizations and programming to produce better outcomes and scale impact. A systems-alignment network uses comprehensive and targeted data strategies to understand how the network as a pipeline influences outputs and outcomes for clients. Bettering the *network* is the focus rather than bettering specific member organizations

(Shumate & Cooper, 2021). Based on interviews and archival data, networks that were coded as having a systems-alignment theory of change (1) had some of the following characteristics: organizations layer their programs and services to produce better outcomes for shared clients, client-centered model of working together, and a robust data system that is used to identify gaps in services and leaky pipelines. Networks with none of the mentioned characteristics were coded as not having a systems-alignment theory of change (0).

Analysis

To analyze configurations of sufficient factors to network effectiveness in our 26 cases, we use Qualitative Comparative Analysis (QCA), a comparative case study method based on set theory and Boolean logic (Ragin, 2008; Schneider & Wagemann, 2012). QCA is modeled on principles of equifinality, which states that there are multiple paths to the same outcome; conjunctural causation, which draws attention to combinations of sets to produce outcomes; and asymmetric relations, which states that non-membership in a condition does not translate to the opposite of it. Set-theoretic methods give membership scores to cases based on their membership in a condition or outcome set; in fuzzy set QCA (fsQCA hereafter), cases can be given partial membership in sets based upon calibrated scores. In the language of fsQCA, we express causal conditions in terms of necessity or sufficiency. A causal condition is necessary if the outcome cannot be produced without it, or the outcome is a subset of the condition. A causal condition is sufficient if it alone can produce the outcome without the presence of other conditions, or the condition is a subset of the outcome. To compute results, we used the R package “QCA” (Dusa, 2018).

After computing the results, we performed calibration checks. We created low- and high-threshold calibrations for the educational index, community poverty, and network size conditions

to ensure the robustness of results. We changed scores for full non-membership, the crossover point, and full membership. Calibration checks are recommended to ensure that solutions that surface withhold calibration sensitivity, thus enhancing confidence in theoretical underpinnings (Schneider & Wagemann 2013; Skaaning, 2011). For both low- and high-threshold calibrations, the same solutions were observed.⁵

Results

Measure of Model Success

In fsQCA, model or solution success is measured via high raw consistency followed by high proportional reduction (high PRI) consistency (0.8 or higher). Consistency captures the degree to which cases that share a condition, or a set of conditions, agree with the outcome that is trying to be reached. In fsQCA, the goal is to reach high consistency values, indicated by high PRI. If contradictory configurations are present, indicating *both* the absence and the presence of a condition lead to an outcome, the model would have lower consistency values (Ragin, 2006). Underlying the analysis is the truth table (see Table 3 in online supplement) which describes each configuration and its raw and PRI consistency.

Coverage is a measure of fit. Researchers recommend emphasizing consistency over coverage when executing a test of sufficiency in fuzzy-set QCA. Solutions with higher consistency values are theoretically pertinent, even with low coverage (Flechtner & Heinrich, 2017; Roig-Tierno et al., 2017; Schneider & Wagemann, 2012). The overall model consistency is 0.92, and coverage is 0.86 (see Table 4). All three of our solutions have high consistency and PRI values. They are (1) learning-based theory of change and systems-alignment theory of

⁵ Full results of calibration checks are available upon request from first author.

change, (2) decentralized network governance, not a learning-based theory of change, lower community poverty (3) and decentralized governance, learning-based theory of change, higher community poverty, and larger network size. There are four cases represented in the first solution, three in the second solution, and one case in the third solution. These three configurations constitute our intermediate solutions.

Table 4: Configurations

	Intermediate Solution		
	1	2	3
Community Poverty		⊗	
Network Size			○
Learning	○	⊗	○
Systems-alignment	○		
Network Governance		⊗	⊗
Cases	15, 13, 21, 22	17, 24, 19	20
Consistency	0.859	0.985	1
Raw Coverage	0.422	0.362	0.77
Unique Coverage	0.422	0.362	0.77
Overall Solution Consistency		0.920	
Overall Solution Coverage		0.861	

Note. Frequency cut-off: 1; Consistency cut-off: 0.8/ A circle represents the presence of the condition, and the crossed-out circle represents its absence. Consistency describes the extent to which a configuration or combination of causes is sufficient to produce the outcome. In contrast, coverage represents the extent to which cases with that configuration are a subset of the outcome (Roig-Tierno et al., 2017).

Negative Case Analysis

We conducted a negative case analysis to determine which cases were not associated with an outcome. The analysis of negative cases is recommended because it can support the causal logic that explains the positive cases. Additionally, research suggests performing a negative case analysis when using fsQCA to guard against theoretical inconsistencies between explanations of the outcome (Schneider & Wagemann, 2007). Negative cases investigate the theoretical assumptions that are made in positive cases. If single conditions and configurations leading to an outcome are contradictory or illogical, it increases the need to reexamine and be attentive to initial theoretical assumptions (Mikkelsen, 2017). None of our solutions associated with a positive outcome appeared in negative case results (see Tables 5 and 6 in the online appendix).

High community poverty is present in two pathways that lead to the lack of effectiveness. The first pathway is in combination with smaller network size. The second combination is with learning theory of change, lack of systems alignment theory of change, and highly centralized governance. Together these pathways account for ten cases in the dataset. Highly centralized governance appears in four out of six pathways and is present in ten cases that appear in the outcome.

Discussion

This study set out to answer the sought-after question of what leads to network effectiveness by examining multiple factors like structure, process and functioning, and external community contexts (Cristofoli & Macciò, 2018). But its main contribution was to answer this question without assuming that 1) perceived network success can be counted towards network effectiveness; 2) networks alone are responsible for the changes observed in their community; and 3) singular factors, as opposed to combinatorial, can lead to network success. Evaluation in

networks is complicated because network-level, organizational member-level, and community-level successes can be attributed to a network (Provan & Milward, 2001). For networks established in response to an issue in a community, scholars argue that their effectiveness is best observed through amelioration in the magnitude of the problem within the community (Provan & Milward, 2001; Raab et al., 2015). However, community-level information is hard to collect, and several studies have approached evaluation by examining how the network's success is perceived (Chen, 2010; Lemieux-Charles et al., 2005). Although perceptual measures of effectiveness may closely reflect the network's internal and external legitimacy, they may be a biased representation that lowers the bar for measuring community-level effectiveness. Responses to perceived effectiveness may favor networks with more significant funding for collaboration activities and communication or those that are relatively new and may be given the benefit of the doubt by their members.

Complex social issues like education reform are prioritized by public, private, and civil society organizations acting alone or in partnerships and networks. They, hence, receive interventions from multiple sources, which makes it hard to credit a single intervention or network. This study adopted a model that measured success in a community against state trend lines allowing us to observe how the community compared with others receiving similar state interventions. It also raised the bar for measuring effectiveness by situating each community within its state's context instead of evaluating all communities against a national target for achievement, as Raab et al. (2015) did. Adopting a national target could have allowed more cases to show effectiveness, but it would blur the distinction between communities that receive network intervention in addition to state-level policies and communities that receive state interventions alone. Using multiple data sources, we restricted the number of cases that

demonstrate the effectiveness and stray away from assumptions that could cloud our results. We also observe the value of configurational approaches to understanding effectiveness.

The results highlight three combinatorial approaches which led to a significant improvement in targeted educational outcomes within the community. The first of these approaches is an impressive testimony to the sufficiency of network action to produce results irrespective of other internal and external factors. This design combines the learning and the systems alignment theories of change (Shumate & Cooper, 2021). Networks that adopt the learning theory of change emphasize information- and knowledge-sharing among partners to improve organizational outcomes. These practices can include data-sharing to compare results, equity training, and sharing evidence-based practice methods among members (Shumate & Cooper, 2021).

Networks that adopt a systems-alignment theory of change focus on whole network improvement instead of member outcomes. In these networks, clients are placed front and center as organizations align their services around them. For example, human service organizations coordinate with schools to meet students' physical and emotional needs. Data is gathered and managed to diagnose gaps in services and problems in the community. Programs that feed into each other (i.e., primary and secondary schools) are made more compatible.

Systems alignment and learning theories of change are not mutually exclusive. They each are network approaches based on understanding the scale and complexity of the problem at hand (Shumate & Cooper, 2021). Networks that combine both theories amplify action by recognizing that organizational member satisfaction and growth need to be carried out in tandem with client

services. These networks will carry out routine information-sharing and training among members to empower the community, build partner trust, and internal legitimacy *in combination with* identifying and addressing critical client needs and gaps by aligning programs. Data is shared among partners for learning and transparency and studied to uncover new areas for intervention. Organizations align their programs and services and can learn about the combinatorial impact of their joint efforts.

Two cases that demonstrate the combinatorial value of learning theory of change and systems alignment theory of change are the Hartford Partnership for Student Success (HPSS) in Hartford, Connecticut, and Learn to Earn Dayton, in Dayton, Ohio. HPSS is a network of 20 diverse organizations, including the city of Hartford, the school district, several nonprofits, and local businesses. It serves about 20,000 students. It demonstrates a commitment to the learning theory of change by training partners and providing technical assistance. HPSS ensures systems-alignment standards of action by adopting a community-centric approach to education. They align themselves with the Community Schools Model. The community schools model uses partnerships among schools, health and human services nonprofits, and youth and community development organizations to meet youth and family needs (Caldas et al., 2019). Services are integrated into the school, making them easily accessible, and school social workers help identify needed services. HPSS encouraged its partners to adopt standard metrics for data evaluation and provided technical assistance to do so. This evaluation data allowed them to maintain a laser focus on third-grade reading, chronic absenteeism, opportunity youth, graduation rates, and career readiness while accommodating shifting demographics, including refugee populations.

Learn to Earn Dayton is a network of 55 organizations in Montgomery County, Ohio serving 66,000 students. Its mission is to ensure that 60% of the workforce has a postsecondary credential. They dedicated themselves to providing learning opportunities and training to enhance the quality of programs and services offered by organizations in their network. Their training included assigning coaches to preschool teachers to improve skill-based practices around classroom instruction and better manage children's behavior. These efforts resulted in greater numbers of kindergarten-ready children. A learning theory of change might seem all-consuming with a larger network but Learn to Earn Dayton could attend to organizational development and identify areas for improvement in the community. Their focus on education equity led them to engage with a broad set of human and social service providers, aligning those services with local school districts. Both examples demonstrate how learning and systems alignment theories of change work in combination to improve student outcomes.

In the second configuration, decentralized governance, resource munificence, and the project-based theory of change combined to produce network effectiveness. Consistent with previous research (Rigolon & Gibson, 2021), small networks depend on distributed governance to manage network operations and activities. These decentralized governance practices create an environment where partner organizations are creating and running programs across the community. Thus, shared leadership becomes an essential tool in implementing programs in smaller and more connected networks (Provan & Kenis, 2008). Compared to larger networks with larger task sizes, smaller networks can create programmatic joint inputs and outputs from project-based mechanisms more effectively. In this setting, networks can be effective because their smaller footprint allows partners to understand the advantages and disadvantages of their

programmatic approach more closely. Effective networks, in this configuration, focus on creating multiple programs and services for target groups.

The more that communities can access resources, the more they can support comprehensive change efforts. Networks with low community poverty can fund the creation and sustainment of programs in ways many other communities cannot (Turrini et al., 2010). More entities in the community can invest in programmatic initiatives, especially programs deemed successful (Raab et al., 2015). These programs leverage the deep knowledge networks have about educational trajectories.

Grinnell Campaign for Grade-Level Reading (Grinnell hereafter) and My Brother's Keeper – Mt. Vernon (Mt. Vernon hereafter) are examples of this configuration for network effectiveness. Grinnell's mission is to make sure all students in their target area read at grade level by third grade. Grinnell leverages its smaller size to support project-based mechanisms. Specifically, this network focuses on five primary service areas for students. These service areas are after-school enrichment, healthy readers, attendance, summer learning, and school readiness. This programmatic framework is supported through program offerings of partner organizations. Students access those programs based on their needs at any given time, with no centrally governed path or mechanism on how these programs will be accessed or administered. There is also an expectation that partner organizations will own the programming and work independently to scale impact with minor assistance from the network in this well-resourced community. This characteristic demonstrates the decentralized governance approach Grinnell implements to maintain programmatic initiatives that meet students where they are. Since Grinnell was founded, outcomes for all three examined metrics have improved above the predicted values in the state.

Mt. Vernon's mission is to ensure young people, especially young men of color, can access opportunities to decrease the presence of persistent opportunity gaps in educational outcomes. As a smaller, resource-munificent network, Mt. Vernon relies on its partners at the school district, government agencies, and nonprofit agencies to determine programmatic strategies for students in their networks. Mt. Vernon believes that successful interventional approaches have been too prolonged for youth in their community. To address this problem, they offer after-school and enrichment programs to students who need them the most. Like Grinnell, these programs are managed in a distributed and decentralized fashion, with the host organization being the supporter and champion for that program.

Mt. Vernon and Grinnell highlight how network size and community resources contribute to network effectiveness. These cases also demonstrated when decentralized network governance should be explored as a viable path to produce network effectiveness. Often decentralized governance works well in small networks that aim to produce multiple programs to boost student achievement.

The final configuration associated with network effectiveness was decentralized network governance, learning theory of change, higher community poverty, and larger network size. Only one network was described in this configuration. However, because it is the only configuration that resulted in network effectiveness in the face of higher community poverty, we believe it merits some consideration.

Voyage, formerly the Blue Ribbon Commission to Prevent Youth Violence, began as an initiative of the United Way. It focused on one specific neighborhood in Wilmington, NC, that the police department identified. The network has 36 member organizations. Although the network has a backbone organization, now its own nonprofit organization, the organization's role

is facilitative rather than directive. They rely on community councils, committees, and a youth advisory board to direct the work of the network. They take a data-driven approach that relies on the Center for Disease Control's Social-Ecological Model. Since its inception, their community outreach advocate model, the network's signature program, relies on an evidence-based evaluation of both risk and protective factors for families.

In summary, this research finds three configurations associated with network effectiveness. Across these configurations, there are three implications from the results. First, centralized governance was more often associated with the negative outcome, or network ineffectiveness. It was not included in any of the models of network effectiveness described in this research. As such, this research suggests limitations to centralized network governance in driving network effectiveness, consistent with some previous research (Legendijk et al., 2020; Wang, 2016). Indeed, our research counters Cristoflio and Markovic's (2016) contention that centralized governance would be more likely to produce network effectiveness in resource-munificent environments. Consistent with Provan and Kenis (2008), the second configuration suggests that small networks, in resource munificent environments, use decentralized governance to improve student outcomes.

Second, our research demonstrates the heuristic value of theories of change in explaining network effectiveness. This research suggests that learning and system alignment theories of change in combination produce greater network effectiveness. This research is the first test of Shumate and Cooper's (2021) framework and suggests that the model promises future network research. Namely, theories of change demonstrate how networks add additional value to organizations' work addressing social challenges.

Third, this research answers Carboni and colleagues' (2019) call for more robust and consistent measures of network effectiveness. Using administrative data from states, we hold networks to a higher standard in demonstrating their effectiveness. We argue that networks should demonstrate trajectories of outcomes above and beyond those captured by state-level trends and control demographic differences across communities. With this standard, we find that network effectiveness is relatively rare. Only one network's residuals scores met the threshold for success across all three measures. Four networks only met the criteria for one of the metrics. Eighteen networks' scores were indistinguishable from their state's trend line for the three outcome measures.

Limitations

Although this study robustly analyzes how networks are configured and their association with outcomes for communities, there are some limitations. In using a configurational approach, we recognize that other measures could be used to explain specific outcomes. Some of these measures are urban density, level of funding, and network capacity. Additionally, these cases are based in 11 U.S. states. Other states and national education systems may yield different results. Moreover, selected educational outcomes determining effectiveness may not be the best or leading indicator for student success. Future research should focus on a broader assessment of student academic outcomes or consider other non-academic outcomes that may better account for student well-being.

Conclusion

This study aimed to determine what combinations of network characteristics were associated with positive educational trends in communities. We found three paths that best explain and demonstrate what characteristics in combination are associated with educational

outcomes indicating student success through our analysis. The first path combined learning and systems alignment theories of change. In the second configuration, smaller networks used decentralized governance and a project-based theory of change. Finally, in the only network configuration to include higher community poverty, one network used decentralized governance and a larger network size to enact a learning theory of change.

This study makes three contributions to research on network effectiveness. First, this analysis is a unique approach to studying network effectiveness that controls for general trends, changing metrics, and demographics of localities. In using interrupted time-series and parametric difference-in-difference analyses to create residual scores in this research, network effectiveness is comparative. Networks must be more effective at improving student scores than other similar communities on average since the time of founding. Thus, this research answers Carboni and colleagues' (2019) call for a more robust and consistent measure of network effectiveness.

Second, this research provides the first test of Shumate and Cooper's (2021) framework for network theories of change. It demonstrates the heuristic value of the model in that all three of the configurations include theories of change as a key explanatory factor. In the first configuration, enacting learning and systems alignment theories of change was sufficient to explain network effectiveness. In the other configurations, the theory of change was one part of a broader set of factors that, in combination, was associated with network effectiveness.

Third, this research supports Turrini et al.'s (2010) integrated framework that suggests that network effectiveness is influenced by a combination of network structural, functioning, and contextual characteristics. We find that each of these factors was an important component. However, we especially note that contextual characteristics, community poverty especially, were influential. In this study, 13 of the 26 networks were in communities that exceeded the U.S.

national average poverty rate. Only three of those communities were associated with effective networks, two in the first configuration and one in the third configuration. These results point to the steep challenge that networks face in some community contexts, even after accounting for demographic differences in the measure of network effectiveness.

Cross-sector networks are often formed to respond to complex problems (Isett et al., 2011; Weber & Khademian, 2008). This research suggests that some networks do result in better outcomes through their structure and actions. However, network effectiveness is relatively rare, suggesting that leaders must pay careful attention to both the design of the network and the theory of change for them to live up to their promise.

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