Networks for School Improvement: A Review of the Literature

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Executive Summary

Networks for School Improvement

In fall 2017, the Bill and Melinda Gates Foundation (BMGF) launched the Networks for School Improvement Strategy (NSI) with the aim of significantly increasing the number of black, Latino, and low-income students earning a high school diploma, enrolling in a postsecondary institution, and staying on track to earn a credential with labor-market value. NSIs are groups of secondary schools working in partnership with intermediary organizations to achieve a common goal using continuous improvement methods. Intermediaries play a critical role in coordinating, facilitating, and supporting schools as they participate in NSIs.

Purpose and Methodology

This paper synthesizes the existing research on improvement networks in education and on how such networks can facilitate meaningful improvements in teaching and learning and ultimately in student outcomes. The paper's findings are drawn primarily from a critical literature review of empirical studies on education improvement networks, as well as from interviews with experts in the fields of professional networks and learning. By focusing on the networks most aligned to the NSI model, the paper is designed to provide a knowledge base for a formative evaluation of the NSI strategy, which BMGF has engaged the Columbia University Center for Public Research and Leadership (CPRL) to conduct over the next two years.

Findings

Potential of Networks

The 34 empirical studies satisfying this paper's inclusion criteria analyze 25 unique improvement networks. Outcomes from the 25 networks are categorized into what the originators of the NSI strategy call The Big Three: Network Health Outcomes, School System Outcomes, and Student Outcomes. Although all three qualify as outcomes, they relate to each other as links in a theorized causal change, with healthy networks promoting strong learning systems within schools, which in turn generate robust student outcomes.

1. Network Health Outcomes
   Most of the studies synthesized describe elements of network implementation that appear to produce positive outcomes of the other two sorts defined below. These elements of healthy networks include the development of open relationships and distributed leadership across schools, the ability to provide customized support to schools, and the establishment of strong network data and information-sharing systems.

2. School System Outcomes
   More than half of the empirical studies describe networks' positive impacts on school learning systems related to what BMGF, following Bryk et al. (2010), calls the “Six Essentials (6E’s)” for school improvement. The studies most frequently associated school participation in networks with gains in school use of continuous improvement grounded in data and evidence, distributed leadership, and high-performing faculty. The studies less frequently linked networks to changes in coherent instructional systems, student-centered learning climates, and ties to families and communities.

3. Student Outcomes
   A smaller set of studies examines the final link in the causal chain, connecting healthy networks and strong learning systems in school to outcomes at the student level. These outcomes include academic achievement and attainment, as well as attitudes and behaviors likely to influence academic results, such as learning mindsets and attendance rates.
Conditions for Network Success

Unsurprisingly, outcomes vary by a network’s “context,” “structure,” and “content.” Across these domains, a number of key factors stand out as important ingredients of network success, including several relating to the role of intermediaries.

1. Networks need secure funding at launch that remains stable even if their activities do not demonstrate immediate student outcome improvements.

2. All relevant network participants, including school district leaders and non-school based stakeholders, need to be fully involved early on.

3. Networks need to establish a clear goal and problem of practice that is highly relevant to schools’ needs and contexts.

4. Network sustainability rests upon relational trust that enables network participants to feel comfortable acknowledging challenges and accepting the benefit of each other’s expertise.

5. Effective continuous improvement implementation requires experimentation cycles supported by strong data infrastructure for assessing causal processes and outcomes.

6. Supportive and distributed leadership facilitates the shared decision-making processes, and team diversity expands the sets of skills and experiences, which together help solve complex problems.

Network Challenges

The studies also reported common challenges:

1. Governance systems rooted in bureaucratic rules or high-stakes accountability impede the transparency in practice and results, room for experimentation and failure, and inter-school collaboration that effective continuous improvement practices require.

2. Network members often lack the time to understand and practice continuous improvement and to engage in network activities, which can lead to initial distrust, resistance, and a sense of incompetence throughout the network.

3. Network participants may experience challenges identifying and using data throughout the continuous improvement process, and they may struggle in particular with the types of process data that continuous improvement requires, to drive improvement.

4. Inadequate root cause analysis, as well as misalignment between a network’s overall goal and the needs of individual schools, between individual network members, and between the network’s work and schools’ competing initiatives or reforms, impede the coherence that improvement of networks require.

5. Traditional methods of evaluating treatment effects can be inadequate for measuring the impact of improvement networks, given their experimental nature and variations in the way networks function.
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1. Introduction

Networks for School Improvement Strategy

Guided by the belief that all lives have equal value, that all students must have equal access to a great public education that prepares them for adulthood, but that some populations—especially those in black, Latino, and low-income communities—do not have that same access, the Bill & Melinda Gates Foundation (BMGF) is funding Networks for School Improvement (NSIs). An NSI is a group of secondary schools working in partnership with an intermediary organization to use a continuous improvement process to increase significantly the number of black, Latino, and low-income students who earn high school diplomas, enroll in a postsecondary institution, and are on track in their first year to earnCredentials with labor-market value. Secondary school teams work collaboratively to identify, test, and refine solutions that target a problem and reach an aim common across the network. An NSI's aim should seek to improve outcomes that are predictive of high school graduation and postsecondary success.

The Center for Public Research and Leadership (CPRL) is partnering with BMGF to conduct a formative evaluation of the NSI strategy. This paper synthesizes research on education improvement networks, which can inform the ongoing development of NSIs, and it identifies likely sources of variation in outcomes that the formative evaluation can explore.

The NSI strategy draws on intersecting bodies of research, including research on “bottom-up” (Cohen & Ball, 1999), “commitment,” (Rowan, 1990) and “place-based” approaches to reform, in which educators engage in developing school improvement strategies themselves. Because educators are closest to the work of teaching and learning, interventions are more likely to be customized to local needs, as well as internalized and supported by the school community (Elmore, 2004; McLaughlin, 1987). Educators and school leaders often engage in such commitment strategies through professional learning communities (PLCs) or other teaming structures, which bring them together around common focus areas, interests, or problems.

The results generated by PLCs and commitment strategies are mixed. Without certain conditions in place, these strategies are unlikely to yield positive outcomes in student learning. In particular, to be effective, PLCs should include distributed leadership, trust, disciplined and reflective professional inquiry, access to external ideas, and a focus on results (DuFour, DuFour, Eaker & Many, 2016; McLaughlin & Talbert, 2006; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006). Teams of educators can attain these high-quality attributes by engaging in systematic investigations into teaching practices, which can take the form of action research, inquiry, lesson study, and improvement science—all slightly different approaches to continuous improvement where educators identify situations where results depart from expectations and then use various forms of structured investigation to understand why and make refinements.

NSI also draws on a growing body of research into the use of intermediary-supported networks to develop continuous improvement in schools. Honig (2004) defines an intermediary as “operating independently between two parties to provide value beyond what the parties alone would be able to develop or amass by themselves” (p. 67). Learning from other sectors that engage in continuous improvement across multiple organizational units, intermediary organizations are assembling networks of schools to use structured investigations to solve common problems of practice. Networks can foster innovation because the information exchange across traditional organizational boundaries allows for an influx of ideas to which individual organizations would not otherwise have access (Bryk, Gomez, Grunow, & LeMahieu, 2015; Kerr, Aiston, White, Holland, & Grayson, 2003; Peurach, 2016).

Although improvement networks hold promise for school progress, there is a risk that educators will just “go through the motions” of continuous improvement, particularly when improvement strategies do not align with what individuals believe their schools need, and when the connections and potential for learning across different schools and with an external intermediary are not clear. In such cases, educators perceive the work as just another set of externally dictated reforms that require them to follow out-of-classroom directives with little or no impact on what they do in the classroom—what Peurach, Penuel, & Russell (2018) call “ritualized rationality.” A growing body of literature describes the conditions and processes necessary for networks to avoid this reaction and to lead to real changes in classrooms and outcomes for students. This paper synthesizes that body of work.
Purpose and Organization

This paper describes the research on how networks can facilitate meaningful improvements in teaching and learning. The paper is designed to provide a knowledge base from which to launch CPRL’s formative evaluation of the NSI strategy; as a resource for the burgeoning set of intermediary-supported school improvement networks in action across the United States and abroad; and a source of information for BMGF staff as they reflect on the ongoing design and progress of the NSI strategy.

Below, we first discuss continuous improvement broadly and describe how it has led to important results across different sectors. We then provide an overview of networks and describe education improvement networks in particular. Then, in the Synthesis of Empirical Studies section, we outline the various kinds of improvement networks that currently exist in education settings, describe the outcomes those networks have on Network Health, School Systems, and Student Outcomes, and discuss the sources of variation among networks, distinguishing factors that promote the success of networks from those that inhibit success. The Summary and Conclusion follows, incorporating additional information from expert interviews and summarizing the key ingredients of network success, as well as the key challenges.

Sources Reviewed

This paper is based on a review of the literature addressing the following research question, “How do education improvement networks function and what are their impacts?” Consistent with BMGF’s NSI strategy, we define education improvement networks as networks of at least three pre-kindergarten to postsecondary schools engaging in a systematic continuous improvement process to solve local problems of practice with the help of an intermediary. Excluded from this definition and from the research conducted for this paper are (1) school networks without intermediaries, and (2) networks implementing predetermined interventions developed by an outside organization without significant input from network members and without adaptation to the local context. Although studies of continuous improvement conducted through mechanisms other than networks and through networks outside the education context inform our conceptualization and findings, we limit the systematic synthesis of literature to improvement networks of schools to ensure a manageable sample of studies and to provide information most applicable to the NSI strategy.

We focus the synthesis on literature published after 2007 given several prior comprehensive literature reviews of education networks (Atkinson, Springate, Johnson, & Halsey, 2007; Bell, Cordingley, & Mitchell, 2005; Jackson & Temperley, 2006). These reviews provide important underpinnings on which this paper rests, including descriptions of (1) the theoretical frameworks behind network approaches; (2) key structural features of such networks, including peer-to-peer collaboration; shared leadership and goals; the transfer of knowledge and skills across schools; and inquiry-based, data-driven practice; (3) early evidence of the effects of education networks, including improved student attainment and mindsets; better teacher practice, confidence, and morale; and the creation of closer relationships between schools; and (4) the potential of networks as an improvement strategy, which was just then coming into focus. A small number of pre-2007 studies are included, however, due to their early focus on the confluence of network and improvement methodologies or their influence on more recent studies and on key experts in the field.

A search of the Columbia University Libraries online database with the terms “education reform” and “school improvement networks” yielded 13,397 results. Filtering titles and abstracts, we identified 19 sources that met our inclusion criteria. We additionally

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1 This boundary line is admittedly diffuse. For example, networks engaged in implementing predetermined approaches to improvement may encounter and seek to address common implementation difficulties through collective improvement structures similar to those used by the improvement networks on which this paper focuses. The National Writing Project, Success for All, and the Better Math Network are often given as examples of networks with strong practices in this regard, but they and other networks like them are outside the scope of this paper for the reasons provided above. School district-level continuous improvement strategies with network qualities are also excluded insofar as they apply to all or subsets of a district’s schools. Because these strategies often embed an array of improvement strategies beyond continuous improvement (e.g., the adoption of learning standards, curricula, assessment, and accountability systems), their various attributes are likely to confound the issues on which this paper focuses. The same is true for district-led continuous improvement initiatives that produce networks of schools engaged in similar professional development (PD) or principals addressing common problems, but without implementing continuous improvement at the school-level consistent with the NSI strategy.
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reviewed sources that we located through relevant citations from our initial scan and through recommendations shared during interviews with experts. Of these, 95 met our inclusion criteria. Although expert recommendations served as a check on and greatly enhanced the initial review and helped ensure that important studies were not missed, this scan almost certainly did not capture all relevant studies. In total, this paper relies on 80 sources that discuss frameworks and hypotheses regarding education improvement networks, and 34 sources that present empirical evidence on network implementation or results.

2. Continuous Improvement

Continuous improvement is defined as “an organization-wide process of focused and sustained incremental innovation” (Bessant, Caffyn, Gilbert, Harding, & Webb, 1994, p. 20). It rests on the idea that if people in organizations are clear about their expectations for what they will do and what change will result, and then about what actually happens when they implement their plans, they can learn and improve by studying positive and negative discrepancies between expectations and results. Management consultant and physicist William Edwards Deming (1993) described continuous improvement as a constant effort to decrease variability and inconsistencies on the way toward achieving a goal.

Based on his work in Japan in the 1950s, Deming developed the “Plan, Do, Study, Act” (PDSA) cycle, which consists of four stages: Plan (establish goals and how to achieve them), Do (implement the plan), Study (build new knowledge based on collected measures of how the plan works), and Act (create and implement a revised strategy based on new plans impelled by new knowledge). By repeating the stages, the scope of inquiry expands and generates new answers, as well as new questions (Bryk et al., 2015). Different versions of PDSAs, and the principles of continuous improvement broadly, have generated important positive results across multiple private, public, and social sectors. Below, we briefly highlight examples from a number of sectors to demonstrate the breadth of continuous improvement's application, its many operational forms, and its potential for impact. We selected these examples because they produced demonstrable impact; they made broad, difficult changes; and they are supported by detailed case studies.

Public and Private Sectors/Medical Example: Institute for Healthcare Improvement (IHI)

IHI is an independent nonprofit organization that aims to improve results in healthcare by training healthcare organizations to utilize what it calls “improvement science.” IHI was created in response to evidence of high costs, rates of error, waste, and delay in the healthcare system. Over the past 20 years, it has led dozens of projects in which over 1,000 healthcare organizations have systematically answered three questions: (1) “What are we trying to accomplish?”; (2) “How do we know if change is an improvement?” and (3) “What changes lead to improvement?” By using PDSA cycles and other tools to answer these questions, IHI has, among other accomplishments, reduced waiting time for patients by 50%, employee absences by 25%, ICU costs by 25%, and patients' hospitalization due to congestive heart failure by 50% (IHI website, n.d.).

Private Sector/Medical Example: Cincinnati Children’s Hospital Medical Center

Cincinnati Children’s Hospital Medical Center is one of the largest pediatric hospitals in the U.S. Over 10 years ago, in response to a high number of deaths caused by preventable medical errors, the hospital developed and systematically implemented a set of measures and PDSA-like procedures for answering the following four questions: (1) “Is the care provided safe and effective?”; (2) “Is the healthcare delivery system patient-centered?”; (3) “Is the healthcare being provided in a timely manner?”; and (4) “What was the experience, knowledge and ongoing success rate of treating particular diseases/conditions?” The medical center eventually achieved higher satisfaction rates from patients and their families, a decrease in hospital-acquired infections, a more reliable and efficient care system, improved resource management, and an increase in the number of healthcare delivery system savings (Cincinnati Children’s Hospital website, n.d.).
Private Sector/Manufacturing Example: Toyota Motor Corporation

Toyota Motor Corporation is a Japanese automotive manufacturer founded in 1937. Starting in the 1950s, the company employed continuous improvement techniques to compete with American automotive manufacturers with far greater working capital. American companies addressed frequent assembly-line stoppages by stocking extra inventory at each station and using large maintenance departments to identify and fix problems causing stoppages. Rather than tying up scarce capital in inventory and maintenance departments, Toyota developed a system of quantity and quality measures at each station to provide immediate signals of faulty activity at the next upstream station. It trained and empowered assembly-line workers themselves, then, to halt the assembly line at the first sign of trouble, form a “Quality Circle” or problem-solving team, and solve the problem in real-time using a PDSA cycle. Toyota spread the same process to its suppliers and even customers. These steps helped Toyota outcompete American car manufacturers despite its lack of resources, which were thought to be necessary for success in the auto industry (Spear, 2010).

Private Sector/Energy Production Example: Institute of Nuclear Power Operations (INPO)

INPO is a private regulatory body created by the nuclear power industry in the wake of the 1979 Three Mile Island nuclear accident. It uses continuous improvement methods to avoid nuclear accidents by establishing industry-wide performance standards and indicators and using a Significant Event Evaluation-Information Network (SEE-IN) to develop and spread safety innovations. Through this network, and with support from and accountability to INPO as the network intermediary, every nuclear power plant in the nation uses PDSA procedures to address safety-related deviations from expected practice, including “near misses.” Since 1970, INPO has increased the safety of nuclear plants in the U.S. compared to those operating in other countries, with the result that the industry’s average performance has become substantially higher, safety-related improvement indicators have improved, and the model has been emulated by other industries such as offshore oil drilling in the wake of the Deep Water Horizon oil spill (Rees, 1998; National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, 2011).

Public and Social Sectors/Juvenile Justice Example: Annie E. Casey Foundation’s Juvenile Detention Alternatives Initiative (JDAI)

The Annie E. Casey Foundation is a philanthropic organization that aims to improve the lives of the nation’s children. Following requirements for U.S. Department of Justice (DOJ) grants to public juvenile justice agencies nationwide, the Foundation’s JDAI initiative assembled a network of juvenile justice agencies across the country with the goal of reducing racial disparities and the number of juveniles in detention in the United States. Supporting each other in implementing the DOJ requirements, network members break down their processes into steps from the arrest of young people through the disposition of their cases. Members track the number of detentions risked, the length of detentions, and the racial disparities arising at each step of the process. They also test ameliorative actions for diminishing the number and length of detentions and racial disparities, and they set new expectations and targets for detentions risked, length of detentions, and racial disparities at each stage based on successes achieved through different ameliorative actions. Juvenile justice agencies that are members of the JDAI network not only share effective practices but also benchmark their own actions and results against those of their most successful peers. At the time JDAI was created, the average number of juveniles in detention in the United States each day was around 28,000, and youth of color detention represented approximately 71% of the detained youth. Since JDAI’s launch, participating JDAI sites have reduced their average daily population in detention by 44% without any adverse impact on public safety. (Annie E. Casey Foundation website, n.d.).
Public Sector/Education Example: Aldine Independent School District (AISD)

AISD serves a working-class community in Houston, Texas. In 2005, AISD undertook a major systemic improvement effort to increase student performance overall and to address problems in three of the district’s schools that were rated as “academically unacceptable.” The strategy adopted by AISD’s superintendent, Nadine Kujawa, engaged teachers in a process of building on existing state standards to create new learning expectations for students, developing a new curriculum, and designing a model for literacy and math lessons for all grades. In addition, each school developed its own plan for delivering curriculum and established targets for students to meet the new learning expectations. When student outcomes deviated from the schools’ or AISD’s expectations, educator teams used an inquiry process to identify and test solutions. Both district and school leaders participated in the ongoing monitoring of results. From 2003 to 2011, the proficiency of African American students increased from 35% to 68%; it increased from 45% to 77% among Latino students. The percentage of students taking the SAT/ACT test increased from 55% to 63%; in 2014, high school graduation rates were 82% (Childress, Grossman & King, 2011; Education First website, 2016).

As these examples highlight, continuous improvement approaches have advanced solutions to complex and challenging problems across multiple sectors. Key operating principles are to clearly define strategic goals; develop plans to meet the goals, identify expected actions and resulting changes; test and measure success though partial or full implementation; and learn from and disseminate the evidence produced through those tests. Success is enhanced by including diverse stakeholders with deep knowledge of the problem. Disseminating learnings becomes increasingly effective when networks of organizations engage in shared problem-solving. Lessons learned in one context are transferred and customized to others, as in the cases of IHI, Toyota, INPO, and JDAI. Below, we elaborate on the intersection of continuous improvement and education networks.

3. Improvement Networks: An Overview

Broadly, networks are groups of individuals or organizations that exchange information about common problems or interests through relationships that are “voluntarily entered into” and in which “the autonomy of participants remains intact and there are mutual or joint activities” (Church et al., 2002, p. 12). For instance, members of professional networks voluntarily affiliate with each other by virtue of their shared professional discipline, and they exchange information specific to that discipline. Some networks form organically through informal and episodic interactions and connections, while others are established more formally by an intermediary or “hub” (Daly, 2014; Peurach, 2016). In the education context, networks of the latter sort—the focus of this paper—are increasingly viewed as a powerful mechanism to generate innovation and improvement, as collaborating both within and across school boundaries can allow for the transfer and sharing of resources and knowledge (Brass et al., 2004, Issett et al., 2011, cited in Russell, Bryk, Dolle, Gomez, LeMahieu, & Grunow, 2017).

Improvement Networks

Networks that involve collaboration around common problems using a systematic approach to continuous improvement are known as improvement networks (Cannata, Redding, Brown, Joshi, & Rutledge, 2017; Kerr et al., 2003; Peurach & Glazer, 2012). According to Russell et al. (2017, p. 4), these networks are “intentionally formed,” “highly structured,” and “aim to address a high leverage practical problem.” They are grounded in shared norms and identities and in social connections, trust, and engagement among their members. One important example of such networks are those implementing “improvement science,” a continuous improvement approach that involves using evidence to determine areas of focus, root causes of problems, and possible solutions that then are piloted and refined (Aguilar et al., 2017; Bryk et al., 2013; Hannan et al., 2015). Through coordination among their members, improvement networks spread solutions rapidly, thereby helping the field learn how to improve quickly (Bryk et al., 2013; Hannan et al., 2015).
Intermediaries

Intermediary organizations enable coordination among individuals and organizations in improvement networks. Honig (2004, p. 67) references Peter L. Berger and Richard John Neuhaus’ description of intermediaries’ roles across multiple sectors as “increas[ing] the social connectedness of individuals and service delivery systems...and help[ing] both individuals and systems to adapt and change.” According to Honig, organizations that fit this definition vary along several dimensions: “the levels of government (or types of organizations) between which they mediate, their membership, their geographic location, the scope of their work, and their funding/revenue sources.”

Studies specific to education likewise define the intermediary as the “hub” of a network that provides coordination, facilitation, and support (Bryk et al., 2013; Russell et al., 2017; Peurach et al., Forthcoming). According to the Carnegie Foundation for the Advancement of Teaching (2018), intermediaries are responsible for five functions: They “build capacity” by coaching members on how to use improvement methods effectively; they “orchestrate learning” by creating and facilitating strategies for knowledge sharing; they “cultivate a strong network community”; they engage the network in “site-level improvement routines” such as analyzing and discussing data; and they “measure the network” by collecting data and monitoring its health.

Network Goals

Improvement networks can serve at least two key goals. First, they aim to solve complex problems that schools have difficulty solving either on their own or with the generalized support of, for example, school districts or charter management organizations (CMOs) (Bryk, Gomez, & Grunow, 2010; Peurach, 2016; Smith & Wohlstetter, 2001). Improvement networks do this by facilitating learning through self-conscious structures that draw on the diverse experiences of their members. In describing Englebart’s (1992) model: “improvement networks facilitate learning at three levels: At Level-A, front-line workers learn by trying to improve their practice; at Level-B, organizations learn as individuals share their reflections with each other; and at Level-C[,] networked organizations “share, test, and elaborate ideas for improvement in multiple, diverse organizational contexts.” (Englebart, 1992; Russell, Bryk, Dolle, Gomez, LeMahieu, and Grunow, 2017, p. 7)

As networks engage in such processes, they may achieve a high-order goal by helping schools develop the capacity to engage in continuous improvement in an ongoing way. They develop the infrastructure needed to create and spread new knowledge, including teaming structures, distributed leadership, and the development of dispositions for continuous improvement (Kerr et al., 2003). In the most developed of such systems, improvement methodology actually replaces bureaucracy and other more rigid forms of organizational governance with flexible forms more receptive to innovation and learning (Sabel & Simon, 2011).

Second, improvement networks also provide a new approach to research-practitioner partnerships. In contrast to the more traditional roles of education researchers that typically generate scholarship with limited influence on school practice, researchers participating in improvement networks help to build practitioners’ capacities to think critically about problems and to use research-based interventions as a starting point for inquiry (Johnson, Moeller, & Holsapple, 2013; Russell et al., 2017). Additionally, the action-research and inquiry-based methodology that improvement networks use offer academic researchers new approaches to their work that allow for more timely and practical solutions to rapidly evolving problems.

With this overview as a theoretical framing of the role and purpose of intermediary-led improvement networks, the following sections describe the results of CPRL’s systematic synthesis of the literature on improvement networks of pre-kindergarten to postsecondary schools.

4. Synthesis of Empirical Studies

Below we present findings from the 34 empirical studies satisfying our research criteria, which analyze 25 unique networks. We divide the findings into information on network types, network outcomes, and sources of variation. For each, we present the number of networks to which a finding applies and, in many cases, provide additional information to describe how a particular finding was discussed in the literature.
Network Types

Eight of the 25 networks were discussed in two or more sources, and four of the 34 sources discussed more than one network. (Appendix A lists the networks and associated studies.)

- **Gradespans**
  All 25 were networks of schools, with 20 networks of kindergarten to 12th grade schools, two networks of elementary schools, two networks of high schools, and one network of postsecondary schools.

- **Number of Schools**
  The studies indicated the size of 22 of the 25 networks, which ranged from four to approximately 1,000 schools. Most consisted of about 30 schools.

- **Student Population**
  Seventeen of the 25 unique networks were comprised of schools in the United States with student populations that were either majority black, Latino, or low-income; another network operating outside the United States also involved students who were low-income. Three of the remaining networks operated in countries other than the United States and the remaining four were United States networks that focused on student populations that were not majority black, Latino, and/or low-income.

- **Intermediary Type**
  Eleven of the 25 networks were initiated and/or supported by governmental entities (e.g., districts, provinces), eight were supported by nonprofit organizations (including two CMOs and three community partnerships), and six were supported by university affiliates.

- **Organizational Structure**
  Of 25 networks, 11 had a “spiderweb” structure (Wohlstetter, Houston, and Buck, 2015) where all schools interacted with the intermediary but there was minimal school-to-school collaboration. The other seven networks had a “cascade” structure, in which some schools interacted with the intermediary and then those schools interacted with the other schools in the network.

- **Continuous Improvement Approach**
  As a function of our inclusion criteria, all networks engaged in systematic continuous improvement methods; 21 networks engaged in problem-solving approaches defined as “action research” or “inquiry”; and 16 networks used techniques associated with improvement science, including establishing data-based aims and short cycles of improvement.

Network Outcomes

We categorized the outcomes studied in the 25 networks in our synthesis into what the originators of the NSI strategy at BMGF characterize as “The Big Three”: Network Health Outcomes, School System Outcomes, and Student Outcomes.

Network Health Outcomes describe the strength of the network’s processes, including collaboration, resource sharing, and governance. In the studies reviewed, most findings regarding implementation focused on outcomes that overlap with network health. School System Outcomes describe changes in the efficacy of key systems in schools. Those systems include the Six Essentials (6Es) for school improvement and advancing student achievement, as outlined in the Systems in Schools section of BMGF’s NSI logic model, which in turn are derived from research conducted by the Consortium on Chicago School Research (Bryk et al., 2010): (1) strong distributed leadership, (2) continuous improvement grounded in data and evidence, (3) coherent instructional systems, (4) high-performing faculty, (5) a student-centered learning climate, and (6) family-community-school ties. Student Outcomes refer to student performance levels and learning growth. We include students’ academic and non-academic outcomes in this category.

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2 We explored variation across our sources to uncover differences in outcomes for networks of different types. We did not find differences for gradespans and student population. We found patterns by network size, intermediary type, and organizational structure, which are discussed in the outcome section below (see Network Health Outcomes: Collaboration Between Schools and Network Data Systems; School System Outcomes: Distributed Leadership). We present the results of all subgroup analyses in Appendix E.
Although all three categories qualify as outcomes, they relate to each other as links in a theorized causal change, with healthy networks promoting strong learning systems within schools, which in turn generate positive student outcomes.

Below, we present a summary of which outcomes were reported for each of the Big Three across the studies in our synthesis. We do not discuss how these outcomes were achieved in this section, but do address this question in the Sources of Variation section that follows and in the Summary and Discussion section at the end of the paper.

For each category of outcomes (Network Health, School System, and Student Outcomes), the number of networks with outcomes reported in the literature is provided. Additionally, a breakdown of the number of networks with positive and mixed or negative outcomes is included, followed by illustrative examples.

**Network Health Outcomes** were discussed for 20 unique networks (addressed in 23 of the 34 sources). Positive and negative Network Health outcomes are presented below.

- **Collaboration between schools** (15 networks)*
  - Twelve presented positive outcomes. Networks were noted for helping to build positive relationships (Chapman, 2008; Wallenstein, 2018) and reducing isolation (Wohlstetter et al., 2003) between schools.
  - Four presented mixed/negative outcomes. Some networks developed only inconsistent “pockets of collaboration” (Wohlstetter, Malloy, Chau, & Pohemus, 2013, p. 544).
  - Variation by network type: Not surprisingly, spiderweb networks engaged in positive collaboration between schools frequently compared with hub-and-spoke networks and cascade networks (eight spiderweb networks with positive outcomes). Compared with large networks, small networks engaged in positive collaboration between schools more frequently (five small networks had positive outcomes).

- **Ability to provide customized support to individual schools** (15 networks)*
  - Eleven presented positive outcomes. In one instance, schools were able to opt in or out of the network, placing accountability on the intermediary to provide adequate and customized support (Wohlstetter et al., 2013).
  - Five presented mixed/negative outcomes. In one, it was noted that the network was unable to provide appropriately customized support to some schools in order to replicate the successes found with others (Peurach, 2016).
  - Variation by network type: Small networks were able to provide customized support to individual schools more frequently than large networks (five small networks had positive outcomes).

- **Network data systems** (nine networks)
  - Nine presented positive outcomes. In one network, network data was published annually so member schools could use it as a benchmarking mechanism for future improvement efforts (Hutchings, Greenwood, Hollingsworth, Mansaray, Rose, Minty, & Glass, 2012).
  - Zero presented mixed/negative outcomes.
  - Variation by network type: Sources analyzing governmental intermediary-led networks discussed strong network data systems more frequently than sources analyzing networks.

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3 See Appendix B for subcategories broken down by both the number of sources and networks.
4 Note that networks either have positive or negative outcomes in these areas, not both; however, for networks that were discussed in more than one source, different sources occasionally presented contrasting outcomes. In such cases networks are only counted once toward the total frequency; cases are noted below with [*]. For this reason, the sum of the networks presenting positive versus negative outcomes is at times greater than the total frequency.
5 For a more in-depth look at the variation in outcomes by network type, see Appendix E.
led by nonprofits and university affiliates (six governmental intermediary-led networks had positive outcomes).

- **Governance and leadership structures** (12 networks)
  
  » Eight presented positive outcomes. In two districts, a change in the distribution of leadership assigned to teachers the responsibility of spreading network interventions to schools beyond their own (Cannata et al., 2017b; Wallenstein, 2018), and, in other networks, district staff became more accepting of teacher feedback (Wohlstetter et al., 2014).

  » Seven presented mixed/negative outcomes. In one network, school level staff reported that network leadership lacked legitimacy (Bodilly et al., 2004). In others, teachers reported that networks failed to properly equip them to operate under their newfound autonomy (Wohlstetter et al., 2014).

- **Network connections to researchers and evidence-based interventions** (14 networks)*
  
  » Six presented positive outcomes. In two networks, researchers were directly involved and facilitated the use and dissemination of evidence-based interventions (Cannata et al., 2017a).

  » Three presented mixed/negative outcomes. In one network, intermediary staff did not have sufficient understanding of the available evidence in order to inform the development of interventions in the networks’ schools (Peurach, 2016).

- **Network operating capacity and sustainability** (eight networks)*
  
  » Three presented positive outcomes. One network was noted for its ability to use schools’ and districts’ qualities and strengths to further the network’s overall operating capacity and sustainability (Bhatt, 2017).

  » Six presented mixed/negative outcomes. In three networks described by Wohlstetter et al. (2014), network staff found it difficult to perform their jobs adequately due to geographic spread and time constraints.

**School System Outcomes** were discussed for 23 networks (addressed in 27 of the 34 sources).

- **Strong distributed leadership** (6E-1) (10 networks)*
  
  » Nine presented positive outcomes. In one network, both school leaders’ involvement in network activities (r=0.51) and the distributed leadership among educators in schools (r=0.47) positively correlated with improvements in teachers’ mindsets and practices (Earl & Katz, 2007).

  » Three presented mixed/negative outcomes. In two networks, teachers and staff reported feeling uncomfortable with the new lack of traditional, formal leadership in their schools and were uneasy about who would own which responsibilities (Cannata, 2017b).

  » Variation by network type: Governmental intermediary-led networks had positive leadership outcomes more frequently than those led by university affiliates and nonprofits (five governmental intermediary-led networks had positive outcomes).

- **Continuous improvement grounded in data and evidence** (6E-2). Sources reported on this criterion in two sub-areas: **school-level use of data** (e.g., data entry, data management, and data analysis) and **the use of continuous improvement** (e.g., goal setting, team discussion, innovation, and adaptation).

  » **School-level use of data** (six networks)*
    
    - Four presented positive outcomes. In one network, 80% of staff used network data to help identify strengths and weaknesses in their schools (Hutchings et al., 2012).
    
    - Three presented mixed/negative outcomes. In one network, teachers tended to report only data they felt administrators wanted to see (Cannata, Redding, & Rubin, 2016).
Use of continuous improvement (11 networks)
- Six presented positive outcomes. In one network, continuous improvement practices were embraced by school staff, leading to positive changes in intervention designs (Katz et al., 2008).
- Five presented mixed/negative outcomes. In two networks, teachers and staff were unclear about what continuous improvement was and inconsistently applied it (Cannata, 2017b).

Coherent instructional system (6E-3) (eight networks)
- Five presented positive outcomes. In one network, a shared protocol was developed by teachers to align instructional efforts when working with the same students (TDOE, 2017).
- Three presented mixed/negative outcomes. In some networks, while plans for implementing new coherent systems were initiated, teachers strayed from implementing them with appropriate fidelity in their individual classrooms (Cannata, 2017b).

High-performing faculty (6E-4) (11 networks)*
- Eight presented positive outcomes. In one network, teachers were reported to have increased their creativity and capacity (Cannata, Cohen-Vogel, & Sorum, 2015); in another, teachers were reported to have broadened their repertoire of teaching strategies (Chapman, 2008).
- Five presented mixed/negative outcomes. One network focused professional development on school leadership with the expectation, often not borne out in practice, that knowledge and skills would trickle down (Wohlstetter et al., 2014).

Student-centered learning climate (6E-5) (two networks)
- Two presented positive outcomes. Educators implemented specific instructional changes intended to improve student engagement (Illinois State Board of Education, 2014; Wallenstein, 2018).
- Zero presented mixed/negative outcomes.

Family-community-school ties (6E-6) (five networks)
- Four presented positive outcomes. In two networks, schools realized that challenges could be effectively addressed only by involving parents and the community (Bodilly, Chun, Ikemoto, & Stockly, 2004; Duffy & Gallagher, 2016).
- One presented mixed/negative outcomes. The geographic spread of schools in this network limited community engagement (Wohlstetter et al., 2013).

Student Outcomes were discussed for seven networks (addressed in 12 of the 34 studies). Two of these studies examined causal relationships, four examined correlational relationships, and the remaining sources relied on practitioners’ observations or impressions of how students’ academic outcomes improved as a result of network activity. Since few networks addressed student outcomes, we present all of the outcomes discussed in the available research.

- The studies addressed achievement (grades, work quality, and standardized test scores), attainment (credit accumulation, graduation rates, and postsecondary enrollment rates), and college access and readiness outcomes for seven networks. Of the seven networks, five reported quantified outcomes, including increases in on-track graduation rate (10%), gains in college enrollment rate (5%), gains in the rate of enrollment in four-year colleges (6%) (Illinois State, 2014), increases in applications to in-state four-year public universities (50%) (Aguilar et al., 2017), increases in remedial college course completion rate (42%) (Carnegie Foundation for the Advancement of Teach-
ing, 2017), and differences between remedial college course success rate within and outside a networked intervention (72% versus 21%, respectively) (Huang, 2018).

• Studies addressed attitudes and behaviors (student mindsets, educator-student relationship growth, attendance rates, and student engagement) likely to influence academic results for five networks. Quantified outcomes included increases in school attendance rate (10%) (Illinois State, 2014) and changes in student mindsets such as student interest in math (.39 SD) and anxiety related to math (-.32 SD) (Bryk et al., 2013).

Sources of Variation Across Networks and Schools in Network Outcomes

Sources of variation are factors associated with differences in outcomes across networks or across schools within networks. All of the synthesized literature discussed factors associated with differences in outcomes, with a focus on factors that enable positive outcomes and some discussion of factors that inhibit positive outcomes. This section divides the most frequently mentioned sources of variation into three categories—context, content, and structure—each of which is described below. Note that the following factors are generally associated with variation in all outcomes, including Network Health, School Systems and Student Outcomes.

Context includes qualities of schools prior to the network intervention, including, for example, initial school buy-in, collaboration with local community partners, and the role of the district or CMO. For our analysis, we used human capital, social capital, and the broader contextual landscape (defined below) as subcategories to organize the findings across the research.

Human Capital refers to the entering skills, knowledge, dispositions, and mindsets of school staff and faculty. Studies of 14 networks associated this factor with positive network outcomes.

• The studies most frequently discussed the positive impact of principal and assistant principal leadership (13 networks).

• The studies frequently referenced lack of staff time (eight networks) and lack of faculty and staff knowledge (eight networks) as inhibitors of success. Proger, Bhatt, Cirks, & Gurke (2017), for example, found that a lack of understanding and time led staff to be slow to implement interventions.

• Notably, studies of only two networks mentioned educator skills as a source of positive variation, but this may be due to the fact that most studies did not have baseline measures of such skills.

Social Capital refers to working relationships, common understandings of what staff are doing, and opportunities to share expertise and information. Studies of 15 networks associate this factor with positive network outcomes.

• Sources most frequently cited a collaborative staff and/or distributed leadership as positive factors (nine networks), followed by school staff’s initial acceptance of the role of network leaders in developing an intervention and staff’s belief that the network-driven intervention would lead to positive student outcomes (nine networks).

• Studies frequently referenced an absence of trust within networks preventing an open exchange of information as inhibiting positive outcomes (seven networks). Included in this are initial biases against other network schools that may obstruct the process of sharing information and collaboration between schools (e.g., Cannata, 2017a).

6 Appendix C provides more detail on sources of variation, including the number of sources that referenced each factor.
The **Broader Contextual Landscape** is mentioned as a key factor in positive network outcomes in studies of 13 networks.

- **Efforts by network staff to engage with district leaders** contributed to positive outcomes (eight networks).

- **Government education policies** (e.g., the No Child Left Behind Act, which limited schools’ flexibility to adopt localized interventions (March 2016)) most frequently inhibited positive outcomes (five networks).

**Content** refers to features of continuous improvement, including goal development, data use, and other aspects of continuous improvement methodology.

**Goal Development** appears as a key factor in positive network outcomes in all 25 networks.

- **Identifying and sticking to a particular problem of practice** (16 networks) and **engaging in shared decision-making or distributed leadership as network participants conduct continuous improvement processes** (16 networks) most frequently appeared in the studies as contributors to positive network outcomes.

- Conversely, studies frequently cited a **lack of clarity in goals and continuous improvement processes** as an inhibiting factor (7 networks). Researchers described a disconnect between school staff and the continuous improvement process; for example, in one network “there was not a common language or definition of continuous improvement across their team. This lack of consensus caused staff to feel as though they were doing continuous improvement even when they were not adhering to principles that the team was trying to adopt” (Aguilar et al., 2017, p. 4).

**Particular Continuous Improvement Methods** factor into positive network outcomes in studies of 17 networks.

- **Piloting** (i.e., testing instructional changes or rapidly analyzing the results of those changes) came up most frequently as contributing to positive network outcomes (13 networks). For instance, Chapman (2008) emphasized the value of testing as a way of sensitively adapting interventions to local school cultures and capacities for change, especially for schools with low-income student populations.

- Conversely, studies cited a **lack of particular continuous improvement methods** as an inhibiting factor (four networks). For example, Katz et al. (2008, p. 133) referenced teachers’ resistance to opening their practice to scrutiny as they ideally would in an inquiry-based culture, noting that “transparency is necessary if the ‘doings’ of network activities are to translate into changes in school practices, thereby leading to increased student achievement.”

**Data Use** arises as a factor in positive network outcomes in studies of 19 networks.

- **Sharing information or having the infrastructure to share information efficiently** (14 networks) and **routinely using data** (10 networks) were the data-related factors most frequently linked to positive network outcomes. **Identification of and access to quality data** were also referenced (five networks).

- **Failing to use data routinely** was cited as an inhibiting factor, including as a result of having too little time and too few resources to examine data (four networks).

**Structure** refers to how networks form, convene, connect, secure resources, and establish partnerships with third parties.

**Formation**—how schools are brought into and initially engage in networks—is mentioned as a key factor in positive network outcomes in studies of 17 networks.

- **Early involvement of all network partners** appeared most frequently as a positive factor (nine networks), though description of how that work was done was rare, as most research in the sample began after networks were formed. See Proger et al. (2017, p. i): “Although there is practical guidance for how networked improvement communities should structure this work, few published accounts describe the
process of forming a networked improvement community.”

- **Misalignment in processes and content focuses between the network, district, and/or schools** commonly appeared as an inhibiting factor (six networks), particularly in larger networks. Larger networks had trouble with cohesion and coordinating activities and communication (Hutchings et al., 2012).

**Particular Network Interactions and Activities** are mentioned as a key factor in positive network outcomes by studies of 20 networks.

- **Building professional learning** (11 networks) and **facilitating trust between leaders of schools and network participants** (9 networks) contribute to positive network outcomes. See Katz & Earl (2010): “link and support professional learning communities in schools so that there [was] a strong local locus of change for teachers” (p. 44); Chapman (2008): the “role of the intermediary was to provide external support through “guidance, advice, and critical friendship” (p. 413).

- **Limited time to engage members effectively in network activities** often arose as an inhibiting factor (eight networks).

**Network Brokering** refers to ways the network or intermediary collaborate with stakeholders beyond the schools in the network. Studies of 10 networks mentioned brokering as a key factor in positive outcomes.

- **The inclusion of local players/outside voices in the community** (five networks) and **involvement of larger education organizations** (e.g., unions, nonprofits, other networks) and **leaders** (eight networks) are cited as promoting positive network outcomes. Networks included community colleges, professional associations, and educational researchers and were able to leverage the unique skills/knowledge of each type of participant in developing the intervention (Bryk et al., 2013).

**Network Resources** refer to funding, space, time, and expertise and are listed as factors in positive network outcomes in studies of 12 networks.

- Studies described **access to expertise** (eight networks) and **funding** (six networks) as necessary for positive network outcomes.

- Conversely, studies cited a **need for more financial support or resources** as an inhibiting factor (three networks).

### 5. Summary and Discussion

The continuous improvement literature, the studies synthesized here, the theory papers, the meta-analyses, and interviews with experts on education networks and professional learning in schools together demonstrate that improvement networks are associated with several important positive outcomes. For students, there is evidence that improvement networks are related to increases in academic achievement and attainment, as well as in attitudes and behaviors likely to influence academic results, such as learning mindsets and attendance rates. For school systems, there is evidence that improvement networks are associated with leadership development, empowerment of professionals across all levels of a school, collaborative problem solving, and overall faculty performance.

Unsurprisingly, outcomes vary by networks’ “context,” “structure,” and “content.” Across these domains, a number of key factors stand out as important ingredients of network success, including several relating to the role of intermediaries, while other factors appear to inhibit success. The discussion that follows lists key contributors to and inhibitors of network success, with citations to exemplary relevant sources and supporting quotations from them and from the interviews.

**Key Ingredients for Network Success**

1. **Secure and stable sources of funding** available at the time the network is launched and thereafter, even as networks engage in activities that do not demonstrate immediate results on student outcomes, are important (e.g., Hutchings et al., 2012; Wohlstetter et al., 2003). If funders are “myopic and can’t understand this... they will over again kill off their young” (Donald Peurach interview, March 2, 2018). **Early engagement of all network participants**, including school district leaders...
and non-school-based experts and influential stakeholders, is also important (e.g., Barron et al., 2015; Proger et al., 2017; Bodilly et al., 2011).

2. When establishing the network, the intermediary has an important role in creating with school leaders or securing their agreement to a clear aim or goal around a common problem of practice based on root-cause analysis. It is crucial that network leaders base the aim on reliable information about the needs of participating schools and about their contexts (e.g., Katz & Earl, 2010; Yamada, 2017; Huang, 2018)—and that they continually update that information as conditions change (Wilcox et al., 2015). Oftentimes, “people enter these systems without having any empirical idea about what the network was like before. . .with no clear, accurate, and systematic assessment of the network prior to and during the work it is challenging to implement and support ongoing improvement” (Alan Daly interview, March 7, 2018). Thus, the role of the intermediary is “staying updated with the school teams and with your district contacts, to not only make sure that they’re supporting the work of the network, but that they also are thinking that the network is helping them solve a key problem of practice that they have” (Marisa Cannata interview, March 29, 2018). Moreover, “high[ ]performing schools [are] the ones that [routinely] knew exactly what they wanted, what they needed, and [that] would speak up for themselves” (Priscilla Wohlstetter interview, February 26, 2018). Schools of differing initial capacity require different levels of support in root cause analysis and identifying aims and may benefit from different intensities of co-creation from the intermediary.

3. To sustain network development, trust among network participants, within school teams, and between intermediaries and schools is essential. “You need good, strong, healthy, reciprocated ties that are high in trust. These high quality-relationships result in individuals feeling their input is valued and actually being used” (Alan Daly interview, March 7, 2018). Trust facilitates an open exchange of ideas, which is necessary for recognizing problems of practice and providing critical feedback that can lead to improved interventions. Simply getting along and developing friendships is not enough; instead, the goal is to create relationships that allow for respectful interrogation of assumptions and “to interrupt some of the cognitive biases that we bring to our work with each other, because some of the default practices of collaboration, actually, are more about confirmation than change” (Steven Katz interview, March 1, 2018). Intermediaries can develop trust with schools by being humble and by presenting themselves as “a kind of critical friend, somebody who wants to understand and appreciate their work,” while “serving in a critical capacity” (Donald Peurach interview, March 2, 2018). Intermediaries can help participants to establish and reinforce shared norms for collaboration, which creates a safe space for learning (Pitcher et al., 2016). Trust also can be fostered and maintained through the process of continually articulating network goals, as well as through an open exchange of ideas and honest communication about what is and is not working (Chapman & Mujis, 2013; Wohlstetter et al., 2003; Chapman, 2008).

4. Once established, effective networks engage in continuous improvement with cycles of testing and adaptation. Intermediaries help facilitate continuous improvement and adapt their support to each school’s changing needs (Proger et al., 2017; Chapman, 2008). Having a well-organized data infrastructure supports such processes (Cannata et al., 2016). Intermediaries play a key role in setting up these data systems and assuring they sensitively capture both successes and failures (e.g., Hutchings et al., 2012; Katz et al., 2008; Peurach et al., 2016). “You need some mechanism for capturing the growth spurts” (Charles Sabel interview, February 28, 2018). When possible, reliance on data that already exist is preferable to creating new and elaborate sources of data. “Develop measures that, maybe, are not 100% perfect, but already exist, and are [a] proxy for what you’re trying to get at. Because the more that
people think that they’re engaged in a huge data collection effort . . . [the more] it’s going to turn a lot of people away” (Marisa Cannata interview, March 29, 2018). A key aspect of intermediary capacity is the ability to facilitate the identification and use of local, process data without overwhelming schools.

5. The presence of supportive, distributed, and diverse leadership in schools is necessary, and intermediaries are helpful in developing schools to distribute leadership (e.g., Earl & Katz, 2007; Katz & Earl, 2010; Pitcher et al., 2016). A diverse team brings a varied set of skills and experiences that can help to solve complex problems (e.g., Bryk et al., 2010; Peurach, 2016; Smith & Wohlstetter, 2001). “The distributed leadership inherent in networks represents a major shift in power relationships for schools, so network capacity “depend[s] on the nature of the school culture and the degree to which flexible shared leadership can thrive” (Earl & Katz, 2007, p. 256). For schools and individuals unfamiliar with shared decision-making, the shift to facilitative leadership, collaborative practice, and peer-to-peer learning that is central to networks requires substantial support.

Key Challenges

1. Pre-existing culture and inflexible school governance structures can produce challenges. Ingrained bureaucracies and systems that attach serious consequences to not meeting targets make it more difficult to engage in effective continuous improvement practices, which require transparency, collaboration across classrooms and schools, and openness to the possibility that strategies and solutions are imperfect at first and require testing and revision. The result can be a tendency to play it safe by only reporting data teachers feel administrators want to see or merely going through the motions of continuous improvement (e.g., Cannata et al., 2016; Bhatt, 2017; Pitcher et al., 2016). In addition, improvement networks “require moving beyond traditional roles in organizations” (Alan Daly interview, March 7, 2018), which can add another layer of discomfort, especially for schools with limited distributed leadership. Therefore, intermediaries need to look out for and address resistance from school and district personnel and respond with persuasion, rather than by appearing to force practices on schools, creating pushback. “[You’ve got to] develop knowledge around how to deal with those predictable problems” (Donald Peurach interview, March 2, 2018). The process of shifting culture to one of continuous improvement will take longer at some schools than others, but it can happen as the safety in failure becomes apparent.

2. Implementation obstacles, including a lack of time to understand and practice continuous improvement and to engage in network activities presents a major challenge and can lead to initial distrust, resistance, and a sense of incompetence amongst network members. It is also detrimental to network sustainability (Hutchings et al., 2012; Proger et al., 2017; Wohlstetter et al., 2014). Continuous improvement is time-consuming, as it requires schools to critically and thoughtfully engage in the iterative, experimental processes of implementation, learning, and adaptation (Pitcher et al., 2016). Cross-school collaboration presents an additional time commitment for network members, as they need to share knowledge with each other and apply what other members have learned to their own school contexts (Donald Peurach interview, March 2, 2018; Aguilar et al., 2017). As Joan Talbert stated, “Inquiry, or even just sharing practices, in a network of school leaders doesn’t readily translate into (new) practices within a school or district” (email correspondence, May 16, 2018). It is difficult for schools to dedicate the necessary time to both network activities and to the subsequent school-level implementation that happens afterward, particularly without supportive district policies (e.g., Wohlstetter et al., 2014; Bodilly et al., 2004; Cannata et al., 2015).

3. Network participants may experience challenges identifying and using data throughout the continuous improvement process (e.g., Aguilar et al., 2017; Hannan et al., 2015;
Pitcher et al., 2016). Although schools and teachers do typically collect a tremendous amount of data, they may lack experience with the specific types of process data use that continuous improvement requires to drive improvement (Bhatt, 2017; Cannata et al., 2017; Pitcher et al., 2016). Teachers often use outcome data to assess student progress but have less experience with the process data that is used to measure the implementation of change ideas. It can be difficult to determine which data to use as process data and how to use that data to monitor an intervention’s progress (Marisa Cannata interview, March 29, 2018). In addition, concerns among teachers about how their data will be interpreted and used for accountability purposes further complicate their ability and willingness to use and share data (Bhatt, 2017; Cannata et al., 2016).

4. **Inadequate root cause analysis**, as well as misalignment between a network’s overall goal and the needs of individual schools, between individual network members, and between the network’s work and schools’ competing initiatives or reforms impede the coherence that improvement networks require (e.g., Bodilly et al., 2004; Duffy & Gallagher, 2016). The potential for these challenges increases for schools with lower entering capacity and with larger networks. Low-performing schools have less capacity to obtain help from the network than high-performing schools (Priscilla Wohlstetter interview, February 26, 2018). Larger networks have difficulty spreading effective practices consistently (Cannata et al., 2017) and have trouble coordinating activities and communication; “five to six appeared to be the maximum number that could work together effectively” (Hutchings et al., 2012, p. 91).

5. A number of sources identified as a key challenge the inadequacy of traditional models of evaluating treatment effects when applied to improvement networks, given those networks’ experimental nature and huge variations in network capacity. Indeed, only a small number of studies in our review explored impact on student outcomes. Scholars propose the use instead of a “developmental evaluation” framework to assess networks based on which stage of a learning continuum they have reached—thereby generating holistic insights into networks’ statuses as learning systems and helping them strategically identify how to improve (Peurach et al., 2016). In this view, network evaluators should focus on generating knowledge on “what works and how to make it work,” rather than simply “whether it works” (Cannata et al., 2015).
## Appendix A: Networks in Synthesis

<table>
<thead>
<tr>
<th>Network Name</th>
<th>Intermediary Type</th>
<th>Network Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYC CMOs: Liberty</td>
<td>Nonprofit: CMO</td>
<td>The NYC CMOs provided instructional and operational support, as well as curriculum and instructional materials that could be shared across their respective schools.</td>
<td>Wohlstetter (2014)</td>
</tr>
<tr>
<td>CA CORE</td>
<td>Governmental: District</td>
<td>The CORE districts used a data system tracking multiple measures across schools to work together to improve student outcomes.</td>
<td>Aguilar et al. (2017)</td>
</tr>
<tr>
<td>National Center on Scaling Up Effective Schools (NCSU): Anonymous District A</td>
<td>University affiliate</td>
<td>District A formed a team of school-based staff, university researchers, program developers, central-office leaders, and a district liaison. The team focused on developing student ownership and responsibility.</td>
<td>Cannata et al. (2015); Cannata et al. (2016); Cannata et al. (2017a); Cannata et al. (2017b)</td>
</tr>
<tr>
<td>NCSU: Anonymous District B</td>
<td>University affiliate</td>
<td>District B formed a team of school-based staff, university researchers, program developers, central-office leaders, and a district liaison. The team focused on building personalization for academic and social learning.</td>
<td>Cannata et al. (2017a); Cannata et al. (2017b)</td>
</tr>
<tr>
<td>Carnegie Foundation for the Advancement of Teaching (CFAT): Building a Teaching Effectiveness Network</td>
<td>Nonprofit</td>
<td>CFAT joined with the American Federation of Teachers, the Aspen Institute, the Institute for Healthcare Improvement, and three urban school districts. The network aimed to improve systems of development and support for early-career teachers through a standard feedback process and through the development of trusting relationships.</td>
<td>Hannan et al. (2015)</td>
</tr>
<tr>
<td>CFAT Community College Pathways (CCP): Statway and Pathways</td>
<td>Nonprofit</td>
<td>CFAT created a network of community colleges, professional associations, and educational researchers to develop and implement the CCP program, which aimed to increase student motivation, persistence, and learning skills.</td>
<td>Bryk et al. (2013); CFAT (2017); Yamada (2017); Huang (2018)</td>
</tr>
<tr>
<td>Children First Networks (CFNs)</td>
<td>Governmental: District</td>
<td>CFNs were designed to provide support to schools with increased autonomy in NYC. 60 CFNs were structured into clusters of 11 networks each. Network teams were composed of 15 staff members, including a network leader, operational support, and an achievement coach.</td>
<td>Wohlstetter et al. (2013); Wohlstetter et al. (2014)</td>
</tr>
<tr>
<td>City Challenge: National College</td>
<td>Governmental</td>
<td>City Challenge was a U.K. initiative that worked with community organizations, parents, and pupils to make stakeholders central to all interventions. Its goals were improving school leadership, using data to tackle issues, and sharing learning across schools.</td>
<td>Hutchings et al. (2012)</td>
</tr>
<tr>
<td>COMPASS-AIM</td>
<td>University affiliate</td>
<td>COMPASS engaged teams from different schools and districts to identify strengths, weaknesses, and priorities, and then engage in inquiry cycles.</td>
<td>Wilcox et al. (2015)</td>
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## Appendix A: Networks in Synthesis (continued)

<table>
<thead>
<tr>
<th>Network Name</th>
<th>Intermediary Type</th>
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<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ford Foundation’s Collaborating for Education Reform Initiative (CERI)</td>
<td>Nonprofit</td>
<td>CERI funded collaborations between community organizations that encouraged and sustained kindergarten through 12th grade reform efforts. It emphasized changing the organization and culture of schools.</td>
<td>Bodilly et al. (2004); Bodilly et al. (2011)</td>
</tr>
<tr>
<td>James Madison University; University of Virginia; CFAT</td>
<td>University affiliate</td>
<td>Two institutions of higher education and educators from Harrisonburg City Public Schools formed a network with the goal of using collaboration and improvement science to develop new approaches to improve student motivation.</td>
<td>Barron et al. (2015)</td>
</tr>
<tr>
<td>Los Angeles Annenberg Metropolitan Project (LAAMP)</td>
<td>Nonprofit</td>
<td>LAAMP coordinated school networks composed of five to seven schools located in one district. Networks shared information about curriculum, instruction, and students. Each school network linked up with an external partner to enhance organizational capacity.</td>
<td>Wohlstetter et al. (2003)</td>
</tr>
<tr>
<td>Michigan Focus Networked Improvement Community</td>
<td>Governmental: District</td>
<td>Michigan Focus teams were composed of state education agency representatives, intermediate school district administrators, district representatives, and school principals that engaged in PDSA cycles to improve schools.</td>
<td>Bhatt (2017); Proger et al. (2017)</td>
</tr>
<tr>
<td>MN Statewide System of Support</td>
<td>Governmental: District</td>
<td>MN Statewide System of Support collaborated with six “Regional Centers of Excellence” that engaged school leadership teams to define priorities and implement evidence-based practices based on data analysis.</td>
<td>Proger et al. (2017)</td>
</tr>
<tr>
<td>Network for College Success (NCS)</td>
<td>Nonprofit</td>
<td>NCS included Chicago high schools that worked together to support postsecondary success for students through collaboration, shared learning, use of data, and research-based support for school leadership.</td>
<td>Illinois State Board of Education (2014); Pitcher, et al. (2016)</td>
</tr>
<tr>
<td>Network of Performance Based Schools (NPBS)</td>
<td>Nonprofit</td>
<td>NPBS worked with 205 schools from 45 British Columbia school districts. Its approach included formative assessment, school-wide inquiries, transparent sharing of results, supporting professional growth, and distributed leadership.</td>
<td>Katz et al. (2008)</td>
</tr>
<tr>
<td>Networked Learning Communities Programme (NLC)</td>
<td>Governmental</td>
<td>NLC encompassed 80 networks and approximately 1,000 schools. Six or more schools were grouped in a cluster to improve teacher practice and student learning.</td>
<td>Earl &amp; Katz (2007); Chapman (2008); Katz &amp; Earl (2010); Chapman &amp; Muijs (2013)</td>
</tr>
<tr>
<td>New Tech Network (NTN)</td>
<td>Governmental</td>
<td>NTN worked to improve high schools by transforming the culture and structure of the schools, developing capabilities, and being mindful of the context where the implementation of such measures would take place. It had a central hub and supported over 150 middle and high schools nationwide.</td>
<td>Peurach, Lenhoff, &amp; Glazer (2016)</td>
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Appendix A: Networks in Synthesis (continued)

<table>
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<tr>
<th>Network Name</th>
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<th>Network Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYCDOE: Learning Partners Program</td>
<td>Governmental</td>
<td>The Learning Partners Program, led by the New York City Department of Education, brought together groups of three to eight schools to engage in cross-school inquiry led by central office facilitators.</td>
<td>Wallenstein (2018)</td>
</tr>
<tr>
<td>Roche Center for Catholic Education (Boston College)</td>
<td>University affiliate</td>
<td>Boston College created a network of Catholic schools and each member school formed teams composed of researchers, teachers, administrators, and parents. Teams worked to implement and continuously improve a bilingual instruction program.</td>
<td>Scanlan et al. (2015)</td>
</tr>
<tr>
<td>School Improvement Groups Network (SIGN)</td>
<td>University affiliate</td>
<td>SIGN created cross-school teams that included a site-level administrator, teachers, and central office personnel. Each team provided continuous feedback, evaluation, and review of improvement plans in a collaborative environment.</td>
<td>Gaines (1992)</td>
</tr>
<tr>
<td>Anonymous district</td>
<td>Governmental: District</td>
<td>The network included a total of 34 schools. Each working team was composed of 15 members that developed systems and structures for the implementation of short cycles of classroom observations, provided concrete feedback, and supported teachers’ growth.</td>
<td>Jones (2016)</td>
</tr>
<tr>
<td>Shared Education</td>
<td>Governmental</td>
<td>Shared Education aimed to promote systemic collaboration between 16 partnerships of Protestant, Catholic, and integrated schools. Teachers and students could move between participant schools, giving and taking classes. It empowered teachers as co-creators of collaborative partnerships and practice.</td>
<td>Duffy &amp; Gallagher (2016)</td>
</tr>
<tr>
<td>TN Early Literacy Network (TELN)</td>
<td>Nonprofit</td>
<td>TELN brought together districts seeking practical solutions to a defined problem of practice. Participants engaged in continuous improvement cycles to learn what worked in solving problems in their specific contexts. The initial goal of TELN was to improve early reading outcomes.</td>
<td>TDOE (2017)</td>
</tr>
</tbody>
</table>

Note: All networks served grades K-12 except for CFAT CCP Statway and Pathways (postsecondary), the NCSU Anonymous Districts A and B (9-12), the Roche Center for Catholic Education (K-5), and TELN (K-5).
## Appendix B: Frequency of Outcomes

<table>
<thead>
<tr>
<th>Categories and Subcategories</th>
<th>Positive Sources (N=34)</th>
<th>Positive Networks (N=25)</th>
<th>Mixed or Negative Sources (N=34)</th>
<th>Mixed or Negative Networks (N=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Network Health:</strong> The strength of the system’s processes, including collaboration, resource sharing, and governance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration between schools</td>
<td>10</td>
<td>12</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Ability to provide customized support to individual schools</td>
<td>10</td>
<td>11</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Network data systems</td>
<td>8</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Governance and leadership structures</td>
<td>7</td>
<td>8</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Network connections to researchers and evidence-based interventions</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Network operating capacity and sustainability</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td><strong>School System Outcomes:</strong> Changes in the efficacy of key systems in schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distributed leadership</td>
<td>10</td>
<td>9</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Continuous improvement grounded in evidence and data</td>
<td>7</td>
<td>8</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>School-level use of data</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Use of continuous improvement</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Coherent instructional system</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>High-performing faculty</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Student-centered learning climate</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Family-community-school ties</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Student Outcomes:</strong> Student performance levels and longitudinal growth in learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic student outcomes</td>
<td>7</td>
<td>7</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Non-academic student outcomes</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
### Appendix C: Frequent Sources of Variation

**Context:** Includes qualities of schools prior to the network intervention, including, for example, initial school buy-in, collaboration with local community partners, and the role of the district or CMO

<table>
<thead>
<tr>
<th>Context Subcategories</th>
<th>Sources (N=34)</th>
<th>Networks (N=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human Capital:</strong> Entering skills, knowledge, dispositions, and mindsets of school staff and faculty</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>Positive impact of principal and assistant principal leadership</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Lack of staff time</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Lack of faculty and staff knowledge</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td><strong>Social Capital:</strong> Working relationships, common understandings of what staff are doing, and opportunities to share expertise and information</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Collaborative staff and/or distributed leadership</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>School staff’s initial acceptance of the role of network leaders in developing an intervention and staff’s belief that the network-driven intervention would lead to positive student outcomes</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Absence of trust within networks preventing an open exchange of information</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td><strong>Broader Contextual Landscape:</strong> How the school is situated in and interacts with its institutional field</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Efforts by network staff to engage with district leaders</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Government education policies that limited schools’ flexibility to adopt localized interventions</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

**Content:** Refers to features of continuous improvement, including goal development, data use, and other aspects of continuous improvement methodology

<table>
<thead>
<tr>
<th>Content Subcategories</th>
<th>Sources (N=34)</th>
<th>Networks (N=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal Development</strong></td>
<td>33</td>
<td>25</td>
</tr>
<tr>
<td>Identifying and sticking to the problem of practice</td>
<td>21</td>
<td>16</td>
</tr>
<tr>
<td>Engaging in shared decision-making or distributed leadership as network participants engaged continuous improvement processes</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>Lack of clarity in goals and continuous improvement processes</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td><strong>Particular Continuous Improvement Methods</strong></td>
<td>25</td>
<td>17</td>
</tr>
<tr>
<td>Piloting (i.e., testing instructional changes or rapidly analyzing the results of those changes)</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Lack of particular continuous improvement methods</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>Data Use</strong></td>
<td>25</td>
<td>19</td>
</tr>
<tr>
<td>Sharing information or having the infrastructure to share efficiently</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Routinely using data</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Identification and access to quality data</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Failing to use data routinely</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>
## Appendix C: Frequent Sources of Variation (continued)

<table>
<thead>
<tr>
<th>Structure Subcategories</th>
<th>Sources (N=34)</th>
<th>Networks (N=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formation</strong>: How schools are brought into and initially engage in networks</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Early involvement of all network partners</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Misalignment in processes and content focuses between the network, district, and/or schools</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td><strong>Particular Network Interactions and Activities</strong></td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Network steps to facilitate professional learning by school leaders (coaching and mentoring)</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Network steps to build trust between leaders of schools and network participants</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Limited time to engage members effectively in network activities</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td><strong>Network Brokering</strong>: Ways in which the network or intermediary collaborate with stakeholders beyond the schools in the network and their staffs</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Inclusion of local players/outside voices in the community</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Involvement of larger education organizations (e.g., unions, nonprofits, other networks) and leaders</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td><strong>Network Resources</strong>: Funding, space, time, and expertise</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>Access to expertise</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Access to funding</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Need for more financial support or resources</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>
Appendix D: Methods

The following information describes how we approached the synthesis of findings. It includes our 1) inclusion and exclusion criteria, 2) search process, 3) synthesis of outcome findings, 4) synthesis of sources of variation findings, and 5) the expert interview process. It concludes with a discussion of the limitations of our work.

Inclusion/Exclusion Criteria

Through our systematic review of the literature, we sought to answer the research question, **“How do education improvement networks function, and what are their impacts?”** We defined education improvement networks as having the following components:

- Containing at least three pre-kindergarten to postsecondary schools
- Engaging in systematic continuous improvement, a process for addressing a specific problem of practice by developing, testing, and refining promising solutions
- Solving local problems of practice
- Led by intermediary organizations

To further align our search with the BMGF NSI strategy, we developed additional priority inclusion criteria. We prioritized research on networks that:

- Served predominantly black, Latino, and/or low-income students.
- Served grades six to 12, pre-kindergarten to five, and postsecondary schools in descending order.
- Included public or public charter rather than private schools.
- Functioned in the United States and then international contexts with the greatest similarity to the United States (e.g., United Kingdom, Ireland, New Zealand).

We also prioritized more rigorous sources that were peer-reviewed or published books. We additionally included research briefs, working papers, and dissertations that met our inclusion criteria. We prioritized research that employed quasi-experimental methods, but given the dearth of rigorous research on networks, ultimately we also included qualitative research and correlational studies.

Notably, we excluded certain types of networks:

- Networks implementing predetermined interventions that were not adapted to local contexts
- Networks with districts as the locus of change

We applied this criteria to ensure a manageable, relevant sample of studies and to provide information most applicable to BMGF’s NSI strategy. These other types of networks are potentially relevant, and we drew on this broader base of literature to inform our thinking and discussions in the paper, but we did not include studies of these other networks in the synthesis. The boundary lines are admittedly diffuse. For example, networks engaged in implementing predetermined approaches to improvement may encounter and seek to address common implementation difficulties through collective improvement structures similar to those used by the improvement networks on which the paper focuses. The National Writing Project, Success for All, and the Better Math Network are often given as examples of networks with strong practices in this regard, but they and other networks like them are outside the scope of this paper for the reasons provided above. Also excluded are school district-level continuous improvement strategies with network qualities insofar as they apply to all or subsets of a district’s schools. Because these strategies often embed an array of improvement strategies beyond continuous improvement (e.g., the adoption of learning standards, curricula, assessment, and accountability systems), their various attributes are likely to confound the issues on which this paper focuses. The same is true for district-led continuous improvement initiatives that produce networks of schools engaged in similar professional development (PD) or principals addressing common problems, but without implementing continuous improvement at the school-level consistently with the NSI strategy.

We further limited our initial search to studies published since 2007 because comprehensive studies of education networks were published prior to that year.
Appendix D: Methods (continued)

(Atkinson et al., 2007; Bell, Cordingly, & Mitchell, 2005; Jackson & Temperley, 2006). These meta-analyses provide important underpinnings on which this paper rests, including descriptions of (1) the theoretical frameworks behind network approaches; (2) key structural features of such networks, including peer-to-peer collaboration; shared leadership and goals; the transfer of knowledge and skills across schools; and inquiry-based, data-driven practice; (3) early evidence of the effects of education networks, including improved student attainment and mindsets; better teacher practice, confidence, and morale; and the creation of closer relationships between schools; and (4) the potential of networks as an improvement strategy, which was just then coming into focus. A small number of pre-2007 studies are included, however, due to their early focus on the confluence of network and improvement methodologies or their influence on more-recent studies and on key experts in the field.

Search Process

We completed a multi-step filtering process to develop a comprehensive collection of sources, representative of the available literature that met our inclusion criteria after our initial search.

After compiling resources from an initial pool collected by BMGF and our own search, researchers scanned the sources, reading the title, abstract, and other sections as necessary to assign an inclusion rating (zero to three) based on our inclusion criteria. Sources with an inclusion rating of zero and one were removed from the sample. Researchers then read the remaining articles and more strictly enforced the following inclusion criteria:

- Networks without predetermined interventions using continuous improvement practices
- Presence of an intermediary
- Networks of schools

From the remaining sources, we developed two subsets of sources: (1) sources with empirical analyses that we would include in our systematic synthesis, and (2) other relevant sources that would inform our approach to the research but would not be included in our formal synthesis. Sources excluded from empirical analysis but that we drew on in other sections of the paper included literature reviews and theory papers.

Search Yields

The initial pool of resources collected by BMGF was made up of 52 sources. These sources provided three sources in the empirical analysis and three sources in our other relevant sources.

A search of the Columbia University Libraries online database with the terms “education reform” and “school improvement networks” yielded 13,397 results. Filtering titles and abstracts, we identified 19 sources that met our inclusion criteria. We also performed targeted searches for noted networks/intermediaries (e.g., CA CORE, NCS) returning 14 sources that met our inclusion criteria. We additionally reviewed sources from previous CPRL work and sources found through relevant citations from our initial scan. Of these, 67 met our inclusion criteria.

In an effort to check for any missing key sources, recommendations from interviewed experts served as a check on our initial review. Expert recommendations provided one additional empirical source included in the synthesis and 14 in other relevant sources.

In total, we included the following source types in our review: 80 sources that discussed frameworks and hypotheses regarding education improvement networks, and 34 sources that presented empirical evidence on network implementation or results.

Synthesis

We also synthesized the findings through a multistage process. First, researchers documented what each source presented about network types, outcomes, and sources of variation. We then grouped findings within each of those categories by subcategories created both deductively, based on themes that emerged across sources, and inductively, based on the categories presented in the BMGF NSI logic model and other categorizing schemes embedded in the NSI strategy. Once we had an initial set of categories, researchers re-read the sources while populating an analysis tool that allowed us to tally the presence of each subcategory across articles. Each source was reviewed and analyzed by one
reviewer. After using the analysis tool for a subset of articles, researchers engaged in a norming discussion to ensure tallies were consistently applied. Through this discussion, the team also discussed whether the subcategories captured all key information from the articles that is relevant to NSI, which led to the merging, removal, and addition of categories. This norming and refinement process was repeated two more times after subsequent sub-samples of the sources were reviewed. Below we provide more information for how we developed subcategories within each major section of our synthesis.

**Network Types**

Descriptive categories were largely developed from the inclusion criteria (e.g., gradespans and student population), particularly where variation was most apparent in our initial findings from the literature scan. Where descriptive categories were not explicitly described in our included literature, notably network size, researchers investigated other sources (e.g., those available on the internet) to fill the gaps where possible.

Network structure categories was informed by Wohlstetter et al.’s (2014) network organizations of “hub-and-spoke” and “spiderweb” networks. An additional category, “cascade” networks, originated from a pattern of network organization observed by the research team in the literature that aligned with neither “hub-and-spoke” nor “spiderweb” networks. Networks were coded into structure categories by their primary reviewers after alignment by the research team.

**Outcomes Analysis**

Outcomes were divided into the three categories provided by the BMGF NSI logic model. The three categories include Network Health Outcomes, School System Outcomes, and Student Outcomes.

School System Outcomes were divided into six subcategories. These six subcategories were aligned with the Six Essentials (6Es) for school improvement and advancing student achievement as outlined by the Systems in Schools section of the BMGF NSI logic model and derived from the research conducted by the Consortium on Chicago School Research (Bryk et al., 2010). 6E-2 (continuous improvement grounded in data and evidence) was divided into two further subcategories to more completely capture the nuance of outcomes within 6E-2.

Network Health outcomes were divided into six subcategories. These subcategories emerged from the literature as being particularly important aspects of implementation that could lead to improved school system and student outcomes.

Each source was analyzed by one researcher. To ensure alignment, we used a subcategory guide with examples. Sources were coded at two levels. For major categories, binary coding was used to indicate if the major category was addressed. For the subcategories, we coded for positive outcomes, negative outcomes, or mixed outcomes by source. In instances where sources covered more than one network, outcomes for individual networks also were coded.

The frequencies of major categories addressed and subcategories reported by direction were compiled for both sources and networks. In one instance, individual networks within a source were reported to have outcomes in different directions. In this instance, the source was counted for each outcome direction.

**Subgroup Analysis**

We looked across our sources for variation in outcomes by network types. We attempted analysis by:

- **Gradespans**
  Kindergarten through 12th grade; kindergarten through fifth grade; ninth through 12th grade; and postsecondary

- **Network Size**
  Large and small (divided at the median, M=29.5)

- **Student Population**
  Predominantly black, Latino, and/or low-income and not predominantly black, Latino, and/or low-income

- **Organizational Structure**
  Spiderweb, hub-and-spoke, and cascade

- **Intermediary Type**
  Governmental, nonprofit, and university affiliated
Appendix D: Methods (continued)

• **Primary Network Focus**
  Student achievement, curricular change, teacher/instruction change, socioemotional learning, and postsecondary access

For each subgroup (e.g., hub-and-spoke), we counted the frequency of positive and mixed/negative outcomes for each of our subcategories under Network Health, School Systems, and Student Outcomes. From these frequencies, we looked for instances where there was a clear trend in outcome directionality for a particular subgroup. These instances were then compared with other subgroups in the category to identify relevant variation.

From our sample, only organizational structure, intermediary type, and network size provided evidence of clear trends and noteworthy variation between subgroups. Gradespans, student population, and primary network focus were limited by subgroup size resulting in too few data points to identify meaningful patterns.

**Sources of Variation Analysis**

Informed by NSI strategy materials, sources of variation were divided into three general categories:

• **Context**
  The state of the schools and their surroundings when they first enter the network.

• **Content**
  Approaches to continuous improvement, including, for example, how aims are developed, and what continuous improvement methodology is used.

• **Structure**
  How a network is formulated and how participants engage.

For each category, we explored subcategories of promoters (characteristics of networks that are associated with positive outcomes) and inhibitors (characteristics of networks that are likely to reduce or prevent positive outcomes).

With this framework, the team documented all sources of variation mentioned in the articles. When possible, we aligned subcategories to ideas presented in theory papers about improvement networks and professional learning. For instance, when considering Context, we included the subcategories of “human capital” and “social capital” since these are highly prevalent in the literature. We ultimately used the following categories:

• **Context**
  » Human capital
  » Social capital
  » Broader contextual landscape

• **Content**
  » Goal development
  » Particular continuous improvement methods
  » Data use

• **Structure**
  » Formation
  » Particular network interactions and activities
  » Network brokering
  » Network resources

**Interviews**

Interviews with experts who had conducted research on improvement networks and/or professional learning in schools were completed to further enhance our understanding. Requests for interviews were sent to 10 people, and eight interviews were completed. Interviews were limited to an hour and were guided by a semi-structured protocol. With permission, we recorded and transcribed interviews. At least two researchers were present for each interview; seven were done over the phone and one was done in person. The list of interviewees follows:

• Marisa Cannata, March 29, 2018
• Alan Daly, March 7, 2018
• Steven Katz, March 1, 2018
• Judith Warren Little, March 27, 2018
• Donald Peurach, March 2, 2018
Appendix D: Methods (continued)

- Charles Sabel, February 28, 2018
- Joan Talbert, May 16, 2018
- Priscilla Wohlstetter, February 26, 2018

Through team discussions after each interview, researchers surfaced key themes across interviews and then lead interviewers reviewed interview transcripts and pulled out key evidence supporting those themes.

Limitations

The findings of this paper are based on studies of varying rigor. The 34 empirical sources used in the synthesis of findings were predominantly case studies and qualitative research. Of the 34, only four used quasi-experimental methods offering evidence of causal relationships, and an additional three sources are correlational quantitative studies. The remaining qualitative and case study analyses relied largely on surveys, interviews, and researcher observations.

While it is not possible to draw causal conclusions due to the limited rigor of the available literature, the findings describe the landscape of networked interventions, suggest areas for further inquiry, and provide indications for how networks may improve outcomes.

Although we attempted a thorough scan of the available literature, we most certainly did not capture all sources that are relevant to our research question. Additionally, as a result of our inclusion criteria, we may have inadvertently eliminated sources that could have provided valuable insights for the NSI strategy. Not all networks cleanly align to the NSI strategy, so sources describing such networks may have been excluded. Due to the challenges of separating predetermined interventions from context-specific interventions, we may have drawn our inclusion line in a way that limited available useful information.

Finally, as much as we tried to be systematic in our synthesis of findings, some categories overlap with others. Researchers’ discretion in determining when to count a source as discussing one category of information versus another may have led to inconsistencies. Further complicating this issue is the fact that outcomes across the categories of Network Health, School Systems, and Student Outcomes interact with each other and it can therefore be difficult to discern if one preceded another. Related, there was potential for overlap between sources of variation and outcomes. It became apparent that a source of variation, such as “faculty and staff knowledge base,” was part of a network’s context but could also be changed through network activities and show up as an outcome. These “chicken and egg” situations were resolved by researchers’ assessment of the discussion in each individual source.

Findings in this paper are also limited by the research questions and findings reported by the authors of the available literature. The absence of data related to a given outcome or source of variation does not preclude its existence in a given network. As a result, we were able to report the frequency of findings in outcomes and sources of variation but unable to rule out the presence of outcomes and sources of variation for sources that did not report on them.
Appendix E: Variation of Outcomes by Network Type

**Network Size**
Evidence of trends were revealed in the following outcome subcategories:

- **Network Health: Ability to provide customized support to individual schools**
  - Five small networks had positive outcomes in this area. Two small networks had mixed/negative outcomes in this area.
  - For large networks, positive outcomes were reported as frequently as mixed/negative outcomes (three times each).

- **Network Health: Collaboration between schools**
  - Five small networks had positive outcomes in this area. One small network had mixed/negative outcomes in this area.
  - Four small networks had positive outcomes in this area. Three small networks had mixed/negative outcomes in this area.

**Organizational Structure**
Evidence of trends was revealed in the following outcome subcategories:

- **Network Health: Ability to provide customized support to individual schools**
  - Five spiderweb networks had positive outcomes in this area. One spiderweb network had mixed/negative outcomes in this area.
  - Four cascade networks had positive outcomes in this area. Mixed/negative outcomes were reported for three networks.
  - Hub-and-spoke networks had too few data points to establish a trend.

- **Network Health: Network data systems**
  - Five siderweb networks had positive outcomes in this area. No spiderweb networks had mixed/negative outcomes.
  - Three cascade networks had positive outcomes in this area. No cascade networks had mixed/negative outcomes.

- **Network Health: Collaboration between schools**
  - Eight spiderweb networks had positive outcomes in this area. No spiderweb networks had mixed/negative outcomes.
  - Two cascade networks had positive outcomes in this area. Three cascade networks had mixed/negative outcomes.
  - Hub-and-spoke networks had too few data points to establish a trend.

- **School-level Outcomes: Distributed leadership**
  - Four spiderweb networks had positive outcomes in this area. One spiderweb network had mixed/negative outcomes.
  - Other organizational structures had too few data points to establish a trend.

- **School-level Outcomes: Coherent instructional systems**
  - Four spiderweb networks had positive outcomes in this area. No spiderweb networks had mixed/negative outcomes.
  - Other organizational structures had too few data points to establish a trend.

- **School-level Outcomes: High performing faculty**
  - Three hub-and-spoke networks had positive outcomes in this area. One spiderweb network had mixed/negative outcomes.
  - For cascade networks, positive outcomes were reported as frequently as mixed/negative outcomes (two times each).
  - Spiderweb networks had too few data points to establish a trend.
Appendix E: Variation of Outcomes by Network Type (continued)

**Intermediary Type**
Evidence of trends was revealed in the following outcome subcategories:

- **Network Health: Network operating capacity and sustainability**
  - One network with a governmental-led intermediary had positive outcomes in this area. Three networks with governmental-led intermediaries had mixed/negative outcomes in this area.
  - One network with a nonprofit-led intermediary had positive outcomes in this area. Three networks with nonprofit-led intermediaries had mixed/negative outcomes in this area.
  - Networks with university-affiliated intermediaries had no outcomes reported in this area.

- **Network Health: Ability to provide customized support to individual schools**
  - Five networks with a governmental-led intermediary had positive outcomes in this area. Two networks with governmental-led intermediaries had mixed/negative outcomes in this area.
  - Four networks with a nonprofit-led intermediary had positive outcomes in this area. One network with nonprofit-led intermediaries had mixed/negative outcomes in this area.
  - Networks with university-affiliated intermediaries had too few data points to establish a trend in this area.

- **Network Health: Network data systems**
  - Six networks with a governmental-led intermediary had positive outcomes in this area. No networks with governmental-led intermediaries had mixed/negative outcomes in this area.
  - Networks with other intermediary types had too few data points to establish a trend in this area.

- **Network Health: Collaboration between schools**
  - Seven networks with a governmental-led intermediary had positive outcomes in this area. One network with governmental-led intermediaries had mixed/negative outcomes in this area.
  - Four networks with a nonprofit-led intermediary had positive outcomes in this area. One network with nonprofit-led intermediaries had mixed/negative outcomes in this area.
  - Networks with university-affiliated intermediaries had too few data points to establish a trend in this area.

- **Network Health: Network connections to researchers and evidence-based interventions**
  - Three networks with a governmental-led intermediary had positive outcomes in this area. One network with governmental-led intermediaries had mixed/negative outcomes in this area.
  - Networks with other intermediary types had too few data points to establish a trend in this area.

- **School-level Outcomes: Distributed leadership**
  - Five networks with a governmental-led intermediary had positive outcomes in this area. No networks with governmental-led intermediaries had mixed/negative outcomes in this area.
  - Networks with other intermediary types had too few data points to establish a trend in this area.
Appendix E: Variation of Outcomes by Network Type (continued)

- **School-level Outcomes: Coherent instructional systems**
  - Three networks with a nonprofit-led intermediary had positive outcomes in this area. No networks with nonprofit-led intermediaries had mixed/negative outcomes in this area.
  - Networks with other intermediary types had too few data points to establish a trend in this area.

- **School-level Outcomes: High performing faculties**
  - Four networks with a governmental-led intermediary had positive outcomes in this area. Two networks with governmental-led intermediaries had mixed/negative outcomes in this area.
  - For networks with university-affiliated intermediaries, positive outcomes were reported as frequently as mixed/negative outcomes (two times each).
  - Networks with nonprofit-led intermediaries had too few data points to establish a trend in this area.

**Gradespans**
Of the networks in our sample, 20 of 25 were kindergarten to 12th grade schools with only two kindergarten to 5th grade, two 9th to 12th grade, and one postsecondary network. As a result, subgroup sample sizes were too small to identify patterns in regards to grade level focus.

**Student Population**
The majority of the networks in our sample (18 out of 25) focused on black, Latino, and/or low-income students. Three of the seven networks that did not focus on black, Latino, and/or low-income students were non-U.S. networks. As a result, we concluded that analysis of this subgroup would have limited meaning to the overall analysis.

**Primary Network Focus**
The most common primary network focus was student achievement (12 networks). The 13 remaining networks were divided among four primary network goals: curricular change, teacher/instruction change, socioemotional learning, and postsecondary access. Due to the small sample sizes in networks focused outside of student achievement, we concluded analysis of this subgroup would have limited meaning to the overall analysis.
Appendix F: Annotated Bibliography of Select Sources

The following annotated bibliography includes select sources from our review. We selected sources that provide rich information relevant to the Networks for School Improvement (NSI) Strategy and that figured prominently in the paper.


Bodilly, Karam, & Orr explored the Collaborating for Education Reform Initiative (CERI), a program developed by the Ford Foundation to foster local collaboration among community organizations. To determine the project's outcomes, and to understand whether the grantees were able to reach financial sustainability, the authors conducted a qualitative case study analysis, including document and data analysis, site visits, and survey administration. The authors found that the project resulted in a number of functioning collaboratives. Yet, these collaboratives' ability to meet their goals varied substantially depending on their capacity to find sustainable funding and choose reasonable interventions. The research suggested that for a network to be successful, efforts such as clear communication of goals, alignment between goals, interventions, resources, appropriate timeframes, and use of data, play an important role.


Bryk et al. described an approach to continuous improvement that applies improvement science to education. The authors advocated for education reforms that allow the field to “learn fast to implement well,” rather than to “implement fast and learn slow.” They explained six core principles of how networked improvement communities can bring together researchers and practitioners to use disciplined inquiry to accelerate problem-solving. Examples included efforts to address the high rates of failure among students in community college remedial math courses, and strategies for improving feedback to novice teachers.


Cannata et al. discussed how the use of continuous improvement methods in a networked environment contributed to school improvement along the dimensions of depth (staff beliefs and related actions), spread (innovation reach), ownership (level of engagement in continuous improvement processes), and sustainability (increases in capacity, alignment, and support) of interventions in two high school networks. Both networks are in large, urban districts and are led by an intermediary that is a partnership between district leaders, school leaders, and researchers from the National Center for Scaling up Effective Schools. Through qualitative interviews and observations from network meetings, the authors presented findings on how the network introduces continuous improvement, creates staff buy-in, implements interventions with fidelity across the network, and adjusts to a changing governance model. This paper provided insight into the benefits and challenges associated with a research-practitioner partnership for network intermediaries and a clear example of the “cascade” network structure.


Chapman explored the Networked Learning Communities (NLCs) Programme, which was a collaborative school improvement initiative led by the Networked Learning Group in the U.K. from 2000-2006. To discover the relationship between NLCs and school improvement, Chapman conducted case studies of four schools located in networks facing particularly challenging circumstances. He found no significant short-term gain in academic performance, but NLCs helped to build capacity for continuous improvement to varying extents across the networks. The article emphasized the importance of adaptation to the local context, as well as the importance of cyclical inquiry approaches.
Appendix F: Annotated Bibliography of Select Sources (continued)


Chapman and Muijs explored the relationship between different types of school-to-school collaboration and student attainment. They compared a sample of schools that engaged in inter-school collaboration to a matched sample of schools that did not. The authors identified a relationship between school-to-school collaboration and improved student outcomes.


Duffy and Gallagher explored the Shared Education initiative, which aimed to promote social cohesion and school improvement by encouraging sustained learning between students and teachers from different schools in Northern Ireland. This paper examined previous educational initiatives with a similar goal to Shared Education; discussed the theoretical framework behind the model; and examined a case study of one Shared Education initiative. In regards to the characteristics of effective collaboration, the authors found that collegiality was developed between school faculty and students; shared learning between students was regular and sustained; and the experience of shared learning and collaboration between staff was normalizing. This article described how inter-school networks can work towards broad social improvements, as well as educational ones.


Huang examined the Carnegie Foundation for the Advancement of Teaching's Carnegie Math Pathways, courses that accelerate students' progress to and through college-level mathematics, which were developed through a Networked Improvement Community (NIC) of practitioners and researchers convened by the Carnegie Foundation. The authors employed a pareto analysis to assess Pathway's continued influence on enrollment and completion. They found that students who participated in Pathways demonstrate significantly higher success rates than students who took a traditional course sequence. This report demonstrated the impact of a network that involves an intensive collaboration between researchers and practitioners.


Hutchings et al. evaluated the City Challenge Programme, a multi-faceted school improvement initiative led by the Department for Children Schools and Families in the U.K. from 2008 to 2011. It included a component that involved schools being grouped into “families” and encouraged to benchmark themselves against each other's data. To evaluate the efficacy of the program, the authors conducted document analyses, administered a survey, and collected qualitative data. They found that City Challenge achieved the majority of its initial objectives for school improvement, which were to reduce the number of underperforming schools, to increase the number of good and outstanding schools, and to improve educational outcomes for disadvantaged children. Authors also emphasized the importance of effective leadership and access to funding in facilitating cross-school collaboration.


Katz et al. explored the way networks function by testing a theory of action for the Network of Performance Based Schools (NPBS) in British Columbia, Canada. To discover whether the assumption that networks can encourage new learning, transfer that knowledge across the system, change thinking and practice, and ultimately yield higher achievement, the authors used NPBS as a case study and administered 227 surveys in 72 schools completed by school-level network participants who were selected based on their ability to knowledgeably answer questions about network activities. The authors found that four key features have strong associations with intermediate outcomes:
Appendix F: Annotated Bibliography of Select Sources (continued)


Kerr et al. reviewed the literature on the Networked Learning Communities (NLCs) Programme, an inter-school collaboration and school improvement initiative in the U.K., in order to identify models of NLCs and highlight key characteristics of effective networks. The authors found that there was little consensus on what the models of networking were, but there was more of an understanding of the characteristics that impact network success. These characteristics included shared leadership, a facilitator that helps to broker relationships, formative evaluation procedures, and trust. The analysis established a strong conceptual base and described key features of successful education networks, as well as the challenges that they commonly face.


Peurach, Lenhoff, and Glazer discuss “developmental evaluation” as an improvement-focused evaluation strategy aimed at understanding and advancing networks as “learning systems.” Based on education and organizational research, the authors defined four primary approaches by which school-wide improvement operates: a shell, diffusion, incubation, and evolutionary enterprise. The authors then presented criteria to identify and evaluate network operations. Through an interview and observation-based case study of New Tech Network (NTN), a high school improvement network that promotes college and career readiness, the authors demonstrated how to use developmental evaluation to critically examine school networks as learning systems. This paper proposed a new perspective on the processes improvement networks go through and implications for evaluating the capacities of existing networks.

- Peurach, D. J., Penuel, W.R., Russell, J.L. (Forthcoming). Beyond Ritualized Rationality: Organizational Dynamics of Instructionally-Focused Continuous Improvement.

Peurach et al. explored the dualities that exist in the education improvement discourse, with the two key concepts being “ritualized rationality” and “instructionally-focused continuous improvement”. Ritualized rationality refers to structural responses to accountabilities, while instructionally-focused continuous improvement emphasizes daily activities that bring about classroom improvement. To discover the organizational dynamics that support the latter, the authors conducted analyses of conditions surrounding schools, networks, and educational environments. They found promoting instructionally-focused continuous improvement depends on the “dynamics in and among agencies, organizations, and interests in educational environments.” The embedded bureaucracy in educational environments presented a key challenge, as it is contradictory to the iterative and recursive cycles of continuous improvement.


Pitcher et al. analyzed the Network for College Success (NCS) model, a network of high schools in Chicago that supports schools in improving their systems and structures. The authors conducted a descriptive analysis of NCS through interviews with various stakeholders. They found that schools need support to maintain a focus on core problems. Also, school leaders need to develop systems, structures and practices to support improvement, as well as to allow opportunities for cross-school learning. The authors highlighted four key elements: (1) fostering professional learning; (2) applying research-based data to practice; (3) providing coaching and capacity building; and (4) distributed leadership and high-functioning teams.

Russell et al. constructed a framework for the initiation of networked improvement communities (NICs), which they define as structured, intentionally formed collaborations that address a high leverage problem in an effort to help the education field execute the NIC concept. Drawing on theory, research, and case studies, they found five domains of activity that were critical in initiating a NIC: developing a theory of practice improvement, learning and using improvement research methods, building a measurement and analytic infrastructure, leading and operating the network, and fostering culture, norms, and identity consistent with network aims. The framework draws attention to the challenges of network formation and provided a useful starting point for those seeking to initiate an NIC.


Wilcox explored COMPASS-AIM, an intervention that engages teams from different schools and districts in inquiry cycles in order to build their capacity in evidence-guided decision making. To discover educators’ perceptions of the impact of COMPASS-AIM on their decision-making capacity, the authors conducted case studies of 36 schools, using both quantitative and qualitative data. The authors found that the majority of educators reported increases in competence in all dimensions of evidence-guided decision making, and that COMPASS-AIM shifted their focus to systemic changes to achieve system-wide goals. The paper illustrated the power of PDSA cycles as a continuous improvement tool and emphasized the need for intermediaries to help educators build their continuous improvement capacity.


Wohlstetter, Houston, and Buck explored the role of networks in the implementation of Common Core Learning Standards in New York City. The authors used qualitative methods to compare the experiences of two Children’s First Networks (CFNs) and two CMOs. They discuss the importance of network structure (hub-and-spoke versus spiderweb networks) in network alignment and effectiveness, targeted professional development, and the ability of networks, schools, and staff to effectively implement new curricula. They found variation between CFNs and CMOs and also between the two CMOs. For example, CFNs’ hub-and-spoke networks inhibited network alignment and effectiveness compared to the CMOs’ spiderweb networks. This paper served as a useful resource for comparing how sources of variation in context, content, and structure can lead to differential outcomes.
References


References (continued)


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