

Learning Networks of Schools: The key enablers of successful knowledge communities
Réseaux d'apprentissage des écoles : les facilitateurs clés de la réussite des communautés du savoir

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Résumé de l'article

Dans le but de créer un niveau d'apprentissage en profondeur (*deep learning*) nécessaire aux intervenants pour que ces derniers apportent des changements importants dans les salles de classe, les réseaux professionnels sont de plus en plus promus comme des mécanismes de création du savoir qui peuvent susciter le genre de changements qui feront une différence pour les élèves. Cet article permet d'explorer le mode de fonctionnement des réseaux en faisant l'essai d'une théorie de l'action au sein du réseau Network of Performance Based Schools (NPBS) en Colombie-Britannique, au Canada. Il décrit les réseaux comme des systèmes collaboratifs qui appuient des façons particulières de travailler et qui trouvent une application dans deux unités organisationnelles distinctes – le réseau lui-même et ses écoles participantes.

LEARNING NETWORKS OF SCHOOLS: THE KEY ENABLERS OF SUCCESSFUL KNOWLEDGE COMMUNITIES

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ABSTRACT. In an effort to intentionally create the level of deep learning necessary for practitioners to make meaningful changes in their classrooms, professional networks are increasingly being promoted as mechanisms for knowledge creation that can make a difference for students. This paper explores the way networks function by testing a theory of action within the Network of Performance Based Schools (NPBS) in British Columbia, Canada. It presents networks as collaborative systems that support particular ways of working and find expression within two distinct organizational units – the network itself and its participant schools.

RÉSEAUX D'APPRENTISSAGE DES ÉCOLES :

LES FACILITATEURS CLÉS DE LA RÉUSSITE DES COMMUNAUTÉS DU SAVOIR

RÉSUMÉ. Dans le but de créer un niveau d'apprentissage en profondeur (*deep learning*) nécessaire aux intervenants pour que ces derniers apportent des changements importants dans les salles de classe, les réseaux professionnels sont de plus en plus promis comme des mécanismes de création du savoir qui peuvent susciter le genre de changements qui feront une différence pour les élèves. Cet article permet d'explorer le mode de fonctionnement des réseaux en faisant l'essai d'une théorie de l'action au sein du réseau Network of Performance Based Schools (NPBS) en Colombie-Britannique, au Canada. Il décrit les réseaux comme des systèmes collaboratifs qui appuient des façons particulières de travailler et qui trouvent une application dans deux unités organisationnelles distinctes – le réseau lui-même et ses écoles participantes.

The world is becoming a networked environment. This is having a profound impact on the way we organize at the local, national and international level. (Church, Bitel, Armstrong, Fernando, Gould, Joss, Marwaha-Diedrich, de la Torre & Vouhé, 2002, pg. 1)

For decades, numerous school improvement models have attempted to reform the thinking and practices of practitioners with the explicit intent of increasing student success in schools. Introducing reforms into classrooms

and schools has generally accomplished superficial changes to practices and outcomes that have not easily translated into sustainable improvement for student learning (Hargreaves, 2003). In an effort to intentionally create the level of deep learning necessary for practitioners to make meaningful changes in their classrooms, professional networks are increasingly being promoted as mechanisms for knowledge creation that can lever the kinds of changes that make a difference for students. Although many different education-based networks have emerged in England, the U.S., and Canada, there is no existing theory of action that elucidates the mechanism by which networks work for student success. This paper responds to this need by exploring the way networks function by testing a theory of action within the Network of Performance Based Schools (NPBS) in British Columbia, Canada.

NETWORK THEORY

The OECD study on sustainable flexibility (OECD, 1997) points to the changing nature of work and life in the knowledge society of the 21st century. In this society, lifelong learning is a cornerstone of the flexibility necessary for highly skilled and educated citizens to take on new tasks and continuously adapt to new and changing environments. As we exit the industrial age, characterized by a “finite” conception of resources, a “controllable” conception of information, and a “sequential and task-specific” conception of learning, the notion of networks takes on increased relevance (Allen & Cherrey, 2000). Specifically, networks provide an operational construct for educational provision and a new vehicle for achieving change.

In this knowledge society, practices for facilitating knowledge creation and sharing are considered to be the key tenets of educational provision. Knowledge will be, and perhaps already is, the most critical resource for social and economic development (Hakkalainen, Palonen, Paavola, & Lehtinen, 2004). Change-directed improvement comes in the form of creating new knowledge or adding value to existing knowledge rather than simply appropriating existing knowledge resources. A fundamental challenge for education then is to organize work with knowledge in a way that facilitates on-going knowledge building and sharing among members of the community. As Hakkarianen et al. (2004) remind us, members of the community need to develop competencies that allow them to function as “knowledge workers.”

In *Working Laterally*, Hargreaves (2003) describes the demands of knowledge creation (and its supportive competencies) in terms of innovation. Knowledge creation (or transformation) is – in a word – innovation. Young people need to be innovative to succeed in work and life, and education is an institution that can both model this requirement and also support its development. Innovation, for teachers, is about learning to work differently

in order to work better. For teachers, most innovation is the creation of new professional knowledge about their work.

Historically, the route to understanding (and supporting) innovation has been individualistic and subject to a cognitive bias. This cognitive bias has paid more attention to mental processes and events at the level of individual agents than to concrete activities that are distributed across several agents in particular contexts and are dependent on characteristics of their social organization. Alternatively, many proponents of the knowledge society focus almost exclusively on the organizational level and examine those organizational practices that elicit knowledge creation to the exclusion of cognitive competencies, without which participation in this society is impossible. Hakkarainen et al. (2004) argue that both are necessary. Networks, as a dynamic organizational form that can mediate between the personal and social worlds, have the potential to capture the complex and reciprocal relationship between individual and collective competencies. Networks can “feed the creative co-production of new knowledge that is the source of better professional practice and renewed professional pride” (Hargreaves, 2003, pg. 4).

The question of function, or how networks “work” in the service of the kind of educational reform that Hargreaves (2003) describes, is one best answered in the tentative terms of “promise.” The route is no doubt circuitous. Judith Chapman and David Aspin (2003) suggest the following possible pathways of function:

- Networks offer a means of assisting in the policy implementation process by linking policy both horizontally and vertically.
- Networks provide a process for cultural and attitudinal change, embedding reform in the interactions, actions, and behaviour of a range of stakeholders.
- Networks provide an opportunity for shared and dispersed leadership and responsibility, drawing on resources in the community beyond education.
- Networks can be capacity building insofar as they are able to produce new knowledge and mutual learnings that can then feed back and inform public policy.
- Networks can move attention away from a preoccupation with micro-level change at the individual site and function at the meso-level to strengthen interconnections and spread innovation across all levels – micro, meso, and macro.

The educational landscape is populated by networks with a multiplicity of variations. In England, government sponsored networks have developed to

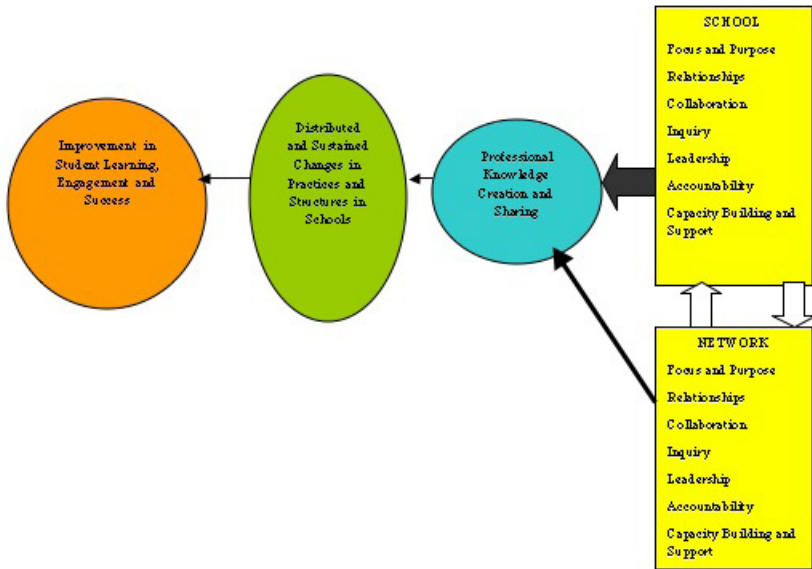
encourage and support continuous cooperative learning at all levels of the education system. In the U.S., the growth of organic networks of teachers and administrators has taken place over the past 20 years without a formal government-sponsored infrastructure. Some networks join teachers and/or schools together on a national level. The National Writing Project, for example, is a teachers' national network devoted to a consideration of writing (Lieberman & Wood, 2002). Other networks are bound by jurisdiction, such as the Consortium for Educational Change, a network of school districts in Illinois created to improve student achievement by assisting member districts and schools to become collaborative, high performing organizations. Likewise, the Bay Area School Reform Collaborative (BASRC) is a network of schools in the San Francisco Bay Area that collaborate to achieve equity-minded school reform (Center for Research on the Context of Teaching, 2003).

In this paper, we seek to better understand how networks work by charting out and testing a particular theory of action in one educational network – the Network of Performance Based Schools (NPBS) in British Columbia. We explicate the theory of action in some detail, describe the NPBS organization, outline our research methodology, and distill the key messages from the data by referring back to the theory of action.

Our theory of action is illustrated in Figure 1. It articulates the theoretical logic by which networked learning communities are presumed to have an effect. We argue that understanding networked learning communities from a theory of action perspective has to begin with the end in mind. Rather than networking for the sake of networking, the explicit and intended impact of networked learning communities is to enhance student learning and engagement (the ultimate outcome), the antecedent of which is a change in teacher practice (an intermediate outcome). Changed teacher practice, in turn, is preceded by a protocol of knowledge creation and sharing (intermediate outcome). It is here – knowledge creation and sharing – that the collaborative underpinnings of networked learning communities as a dynamic organizational form find expression and effect.

The networked learning theory of action is based on knowledge creation theories of learning rather than theories of replication or transfer. Earlier we noted the historical propensity to understand and support knowledge creation by focusing on what individuals do “in their head.” More recently, learning theory has added the notion that knowledge creation is a process of participation in various cultural practices and shared learning activities, rather than a process of individual knowledge formation – “individual in social action.” Both are necessary, with knowledge created through dialogue or conversations that make presuppositions, ideas, beliefs, and feelings explicit and available for exploration.

FIGURE 1. Networked learning theory of action



Networks have the potential to engender what Hakkarainen et al. (2004) talk of as networked expertise. Networked expertise refers to higher-level cognitive competencies that arise, in appropriate environments, from sustained collaborative efforts to solve problems together. Networked expertise is relational in nature. It emerges from tailoring individual competencies to specific activity environments, and is represented as a shared competence of communities and organized groups of professionals. Rumelhart describes the products of such socially distributed cognitive systems this way:

One person's half-baked suggestion resonates in the mind of another and suddenly takes a definite shape. An insightful critique of one way of thinking about a problem leads to another, better understanding. An incomprehensible simulation result suddenly makes sense as two people try to understand it together. (Hakkarainen et al, 2004, p. 149)

Embedded in this notion of knowledge creation is a valuing of both explicit and tacit knowledge (Hoban, 2002). Explicit knowledge is externally created, measurable, and expressed formally; tacit knowledge is personal, subjective, and embedded in individual experiences, actions, intuitions, and values. Innovative solutions, according to some theorists (Nonaka & Takeuchi, 1995; Von Krogh, Ichijo & Nonaka, 2000), arise when individuals draw on outside explicit knowledge and combine it with tacit knowledge in response to authentic problems.

If deep change comes from creating new knowledge, a fundamental challenge for education is to operate in a way that facilitates on-going knowledge creation and sharing among members of the community, to tap both tacit and explicit knowledge, and to process it. Members of the community need to develop competencies that allow them to function as “knowledge workers” who can engage in a productive interchange between tacit and explicit knowledge to generate new collective knowledge that is explicitly codified so that it is accessible throughout the organization (Hakkarianen et al., 2004).

The task of “enabling” knowledge creation and sharing can be conceptualized as the outgrowth of a community of practice (COP) or – to better underscore the key ingredient of intentionality that we have been highlighting – of an innovative knowledge community (IKC) (see Paavola, Lipponen & Hakkarainen, 2004 for a description). That is, while networks differ in the way they go about doing their work, they share the general function of bringing participants to build IKCs. In our theory of action, networks, as collaborative organizational forms, support particular ways of working that find expression as these IKCs within two distinct organizational units – the network itself and the schools that are represented.

Several studies have found positive associations between the presence of COPs (or IKCs) within particular schools and the schools’ success in enhancing student engagement and achievement (Bryk & Schneider, 2002; McLaughlin & Talbert, 2001). Our theory of action suggests that networks can foster the development of school IKCs by: a) linking newly emerging ones to their more developed counterparts; and b) creating new IKCs at the network level that enable knowledge creation and sharing. What becomes important then is the strength of attachment between schools and networks such that established school-level IKCs can upload their key feature practices into the network – thus creating a network IKC – that in turn allows other school IKCs to download and instantiate these enablers of knowledge creation and sharing. What connects schools to networks (and networks to schools) is, ultimately, individuals – whether it be directly through active participation or through the construction of artifacts that serve boundary spanning functions. The study of individuals as the connective tissue of networks takes place at the individual level and is typically accomplished through social network analysis (see Hite, Williams, & Baugh, 2005, for an example). Social network analysis considers the nature and roles of particular individuals as they connect to others, both within and across organizational boundaries. Our work looks at the organizational (school and network) products (in terms of IKC practices that enable knowledge creation and sharing) of these interactions.

The enablers of innovative knowledge communities

The right side of Figure 1 reflects seven categories of IKC practices that our review of the literature identified as potential network enablers of knowledge creation and sharing. These Key Features of learning networks are: Purpose and Focus; Leadership; Relationships; Collaboration; Inquiry; Accountability; and Capacity Building and Support. Innovative knowledge communities are a complex interaction between structures and activities. Each of these Key Features has a role to play and, as in any complex system, the ways in which they combine and interact are innumerable. A central characteristic of complex systems is the interdependence of the constituent elements, with each one being connected to all the others. A change in any one invites changes in the rest (Sutherland & Katz, 2005). The Key Features are described in more detail elsewhere (c.f. Earl & Katz, 2005; Katz & Earl, 2007). Here we provide a brief review.

Purpose and focus

Stoll (2004) suggests that having a fundamental and clear organizational purpose is critical to the success of professional learning communities and of networked learning communities. In a general sense, successful educational change is driven by a pervasive commitment to improving education for all that includes raising the bar and closing the gap of pupil achievement, treating people with respect, improving the environment for learning, and changing the context for learning at all levels (Fullan, 2004).

In addition, a learning focus is likely to have a more direct impact if it is *focused* in ways that are concrete and useful (Timperley & Robinson, 2003), has high leverage in fostering pupil learning (Marzano, Pickering & Pollock, 2001) is compelling, challenging and shared (Lieberman & Grolnick, 1996; Bryk, Camburn & Louis, 1999; Firestone & Pennell, 1997), (checked w. author to be sure above sentence is correct) and is appropriate to the context (Marzano et al., 2001). A compelling and high leverage learning focus is based on evidence that it can have significant impact on teaching practices and pupil learning. A challenging focus is one that requires teachers to reconceptualize, unlearn, or make changes to existing practice and structures, legitimating the change process, making the status quo more difficult to protect, and offering opportunities for joint attention to issues that are larger than any one school could address alone (Timperley, 2004). Finally, the learning focus should be “right” for the participating schools, given their particular context, history, and needs.

Relationships

Relationships form the threads or the “connective tissue” of networked learning communities (Allen & Cherrey, 2000; Church et al., 2002) and

provide the social capital that allows people to work together over time and exceed what any of them could accomplish alone (West-Burnham & Otero, 2004). On one hand, relationships allow a network to knit together (Church et al., 2002). On the other hand, the network provides the mechanisms to support the relationships.

Relationships create a common language and a sense of shared responsibility, provide channels for communicating and disseminating information to one another about network members' expertise, and develop readiness to trust one another (West-Burnham & Otero, 2004).

Trust is a key condition of productive relationships. Indeed, Bryk and colleagues (1999) found that social trust among members of staff was the strongest facilitator of professional community. They propose that a base level of such trust may be necessary for a professional community to emerge, but working and reflecting together can build trust and strengthen relationships. In relationships, conflict is inevitable – and, as we will see, valuable – but robust and trusting relationships among network members can allow them to work together even when they have different orientations and views (Lieberman & Grolnick, 1996).

Collaboration

Collaboration encompasses much more than relationships. It is intensive interaction that engages educators in opening up their beliefs and practices to investigation and debate. In the model put forward by Church et al. (2002), interactions among network members are characterized as “threads and knots.” The threads represent the relationships; the knots represent the *activities*, the structures and content of collaboration. The knots of collaboration are the vehicles through which schools and networks conduct the work of improvement. When colleagues engage in a dynamic process of interpretation and evaluation of practice they enhance their own practice and that of the profession. This kind of collaboration allows people to address tough problems of teaching (Firestone & Pennell, 1997), build commitment through group understanding (Lieberman & Grolnick, 1996), solve issues of mutual concern (Wohlstetter & Smith, 2000), and spread innovations beyond individuals and single sites (Smith & Wohlstetter, 2001).

Judith Warren Little (1990) offers a useful four-fold taxonomy for examining collaboration: storytelling and scanning for ideas; aid and assistance; sharing; and joint work.

- In Storytelling and scanning for ideas, the contacts are informal and teachers make occasional forays in search of specific ideas, solutions, and reassurances. They gain information and affirmation in the quick exchange of stories, casual camaraderie, and friendships that occur at a distance from the classroom. In this case, teachers do not feel as if there are any problems

to be resolved and they exercise personal preference in who they talk with and how they use the information.

- Aid and assistance occurs when mutual aid or helping is readily available. Questions are interpreted as requests for help and there is the expectation that colleagues will give one another help and/or advice, as well as concern and sympathy, but not interfere in another's work in unwarranted ways. Sometimes the expression of empathy even has the potential to dissuade teachers from more analytic examinations of practice.
- In sharing of methods and materials or the open exchange of ideas and opinions, people make aspects of their work accessible to others and expose their ideas and intentions to one another. Sharing does not usually extend to commentary on curriculum, learning, and instruction.
- Joint work, as Warren-Little describes it, involves "encounters among teachers that rest on shared responsibility for the work of teaching (interdependence), with their motivation to participate grounded in needing each other's contributions in order to succeed in their own work and a confidence in the others' competence and commitment" (p. 10).

Collaboration can be a powerful mechanism for changing ideas and practices, particularly when it involves joint work that includes a balance of personal support with critical inquiry about present practice and future direction (Borko, 2004; Hudson-Ross, 2001) along with sustained scrutiny of practice. Such collaboration is not, however, always easy. In fact, moderate conflict is essential for the development of high joint benefit, and the desire to avoid conflict can undermine this outcome (Engeström, 1999).

Inquiry

Systematic analysis of the situation and professional reflection are regarded as core activities for both individual and collective construction of meaning. We have written elsewhere about having an *inquiry habit of mind* – a habit of using inquiry and reflection to think about where you are, where you are going, how you will get there, and then turn around and rethink the whole process to see how well it is working and make adjustments (Earl & Katz, 2002, 2005).

Knowledge creation, especially when individuals are involved in changing their practice, requires that individuals consider explicit knowledge, and share, question, and possibly adapt their respective tacit knowledge, in order to create new collective explicit knowledge. Little (2005) references a large body of research suggesting that conditions for improving learning and teaching are strengthened when teachers collectively question ineffective teaching routines, examine new conceptions of teaching and learning, find generative means to acknowledge and respond to difference and conflict, and engage actively in supporting one another's professional growth. The inquiry processes of questioning, reflecting, seeking alternatives, and weighing

consequences promote the “transparency” of what otherwise might remain unobservable facets of practice – making tacit knowledge visible and open to scrutiny (Earl & Katz, 2002; Little, 2005).

Collaborative inquiry creates an opportunity for educators to work together, searching for and considering various sources of knowledge (both explicit and tacit) in order to investigate practices and ideas through a number of lenses, to put forward hypotheses, to challenge beliefs, and to pose more questions. When educators have an inquiry habit of mind, they have developed a *way of thinking* that is a dynamic iterative system for organizing ideas, seeking out information, and moving closer and closer to understanding some phenomenon together.

Leadership

Fullan (2004) makes the point that if a system is going to be transformed, leadership at all levels must be the primary engine. Networked learning communities include many levels of leadership – both formal and informal. Networks have some system of leadership to direct the work of the network itself, which usually coexists alongside the formal leadership of head teachers in schools. Within networks there are projects and activities that require direction and coordination.

Although the leadership literature continues to emphasise the role of principals/head teachers in successful change and instructional improvement, leadership models are increasingly focusing on what Rowan (1990) called “network” patterns of control, where leadership activities are distributed across multiple people (Smylie & Denny, 1990; Heller & Firestone, 1995). Formal leaders (e.g., head teachers) provide leadership by encouraging and motivating others, setting and monitoring the agenda, allocating resources, sharing leadership, providing support, and building capacity. At the same time, networked learning communities encourage distributed leadership in schools and across the network, with many people (with and without formal positions of authority) providing a range of leadership functions such as leading particular initiatives, participating in collaborative groups, supporting colleagues learning, and sharing their knowledge with others.

Accountability

Policy makers are demanding that schools focus on achieving high standards for all students, and requiring evidence of their progress (Fullan, 1999). Both external and internal accountability have a role to play in how change happens.

External accountability in networked learning communities means being open and transparent in showing policy makers and the public what they are doing and how well it is working. Strong external accountability systems

can also contribute to the achievement of a widely shared sense of purpose, create a sense of urgency, provide “pressure” for change, and offer a forum for conversation about the work of schools.

Internal accountability is a process of using evidence to identify priorities for change, to evaluate the impact of the decisions, to understand students’ academic standing, to establish improvement plans, and to monitor and assure progress (Herman & Gibbons, 2001). As Elmore (2002) says:

Knowing the right thing to do is the central problem of school improvement. Holding schools accountable for their performance depends on having people in schools with the knowledge, skill, and judgment to make the improvements that will increase student performance. (<http://www.edletter.org/past/issues/2002-jf/limitsofchange.html>)

Internal accountability is what moves the agenda from schools where teachers and leaders are working hard and showing enthusiasm for change, to schools that are constantly engaged in careful analysis of their beliefs and their practices, to help them do things that they do not yet know how to do (Earl, 1999).

Building capacity and support

Harris (2001) defines capacity building as being concerned with creating the conditions, opportunities, and experiences for collaboration and mutual learning. Years of school improvement research have shown that improving schools are ones that take charge of change, rather than being controlled by it (Hopkins, Ainscow, & West, 1994; Stoll & Fink, 1996). As Senge (1990) describes it, a learning organization is one that is continually expanding its capacity to create its future. In networked learning communities, the focus is on creating the conditions to support individual and collective learning through all of the processes described in the previous key features. Building capacity depends on intentionally fostering and developing the opportunities for members to examine their existing beliefs and challenge what they do against new ideas, new knowledge, new skills, and even new dispositions (Stoll, Fink, & Earl, 2003). When networks are focused on learning, they intentionally seek out and/or create supporting activities, people, and opportunities to push them beyond the status quo within their school and network development.

THE NETWORK OF PERFORMANCE-BASED SCHOOLS (NPBS)

Having explicated our theory of action, we now consider networked learning as a phenomenon within the context of a particular educational initiative – the Network of Performance Based Schools (NPBS) in British Columbia. NPBS has its roots in reflective inquiry and communities of practice. The focus of the Network has remained constant since its inception seven years ago – improving student learning through the thoughtful use of formative

assessment, developing learner metacognition, increasing professional and public confidence through honest and ethical school-wide inquiries and transparent sharing of results, and supporting the professional growth of educators through a model of networked and distributed leadership.

The focus for the Network was initiated by a single question - how can the criteria for quality in citizenship, writing, math problem solving, and reading become widely used on a voluntary basis? This work has since evolved into a broader focus on the development of a provincial knowledge society – a networked learning community for the transfer and utilization of emerging research evidence regarding the power of formative assessment to shift learning for learners and school systems.

In the NPBS, school teams are invited to develop a question related to K-12 learning in reading, writing, numeracy, or citizenship; collect initial evidence using the performance standards; implement classroom strategies focused on improving student learning; attend three after-school meetings to share strategies, ideas, inquiries, and resources with other schools; share their findings in a poster session at the end of the school year; and, write a two-page case study report of their work. The reports are then made accessible to all participating and interested schools through an annual print publication and a web-based version (www.npbs.ca).

In the first year, 34 schools from nine school districts joined the Network. Participation has grown steadily over the past seven years with 205 schools from 45 of the 60 British Columbia school districts now involved. From the original group meeting in the lower mainland, there are now 12 local and regional networks across British Columbia supported by volunteer network leaders in each area.

The connections between formative assessments internal to the school and formal external measures have been tracked since the Network's inception. In addition, recent emerging interest in understanding Canadian forms of networked learning communities has led to local and national research studies to explore aspects of the impact of the Network on leadership and learning. An exploration of sustainability in leadership is just beginning to be added to this research agenda.

The long-term intent of the Network is to be deeply influential at three levels: the learner level – for the individual learner to be supported and informed in their learning and knowledge building; the school community level for the teachers, parents, and principals to be supported and informed about the connections between the emerging evidence about the importance of formative assessment to learning for deep understanding and knowledge building; and the systems level – for systems at the community, district, university, and provincial levels to be influenced by the positive example of an effective way to support learning in a knowledge society.

METHOD

Goddard, Hoy, and Hoy (2004) argue that when the unit of interest is institutional – in our case, the school – aggregating individual perceptions of group capability is preferable to: a) aggregating individual perceptions of self capabilities; and b) asking group members to discuss their group capabilities and come to consensus. The two latter strategies are far more susceptible to social desirability biases than the former, not to mention logistically problematic. They go on to offer evidence that individual perceptions of group functioning yield more variability between groups (schools), which is desirable from a methodological point of view. Our approach, then, was to ask individuals within schools to respond to group (“we” or “teachers in this school”) rather than self (“I”) referent statements on a survey.

Five surveys were sent to each of the 205 schools participating in the Network. Each school leader was asked to select five colleagues (possibly including themselves) to complete the survey. Participants were selected based on their ability to knowledgeably answer questions about network activities in their school. The surveys were completed individually and sent back to us. Participants answered questions about school and network characteristics related to the seven Key Features of innovative knowledge communities discussed earlier in the theory of action. In addition, the survey asked about two of the intermediate outcome measures – knowledge creation and sharing, and changes in thinking and practice. The study did not include measures of the student achievement and engagement outcomes. Finally, the survey also included items that measured the school’s attachment to the network and the perceived influence of the network on the school. The survey was designed with a parallel structure for school and network questions. Participants responded on behalf of their school colleagues (school questions), and on behalf of school colleagues who participated in network activities (network questions).

A total of 1025 surveys were mailed out to schools participating in the NPBS. Prior to the survey mail-out, the NPBS central leaders sent an email to the Network leaders requesting each school’s participation in the study and explaining its importance for program improvement. Two reminder email messages were sent to the Network leaders, once upon receipt of the surveys, and the other prior to the return date. In all, 227 individuals in 72 schools sent back surveys with an average of 3.2 completed surveys per school. This represents a 35% school-level response rate.

The survey contained 225 items measuring 8 school-level and 8 parallel network-level Key Features, 2 intermediate outcomes, and 2 measures of perceived importance and influence of the network. The Leadership Key Feature was divided into Distributed Leadership and Formal Leadership. All the items, with the exception of the last section of the survey, had 5 response

categories and a clear additional choice for respondents to check DK (Don't Know) on items for which they did not know the answer. The last section on network effects on the school contained items with 4 options and DK. Scale scores were computed using the mean item response method when at least half the items had been answered using the 4- or 5-point scale. Scores were set to missing for those who had omitted or marked DK for more than half the items. All statistical analysis was done using SPSS release 13.01.

Network leaders supplied a dichotomous assessment of each school's level of association with the network, information external to the survey. About 60% of the 205 schools were categorized as having high and 40% as having low network involvement. The categories were based on completion of network requirements such as attending all meetings, presenting findings, and submitting a school report. The small difference in rate of participation in the survey between schools in the two categories was not statistically significant.

RESULTS

The following section contains descriptive data on the scales, correlations of Key Features to intermediate outcomes, and network association. In addition, *t*-tests were performed to compare the various measures between schools with high and low association with the network. Table 1 shows descriptive data about the scales. The number of valid responses is lower for the network items than the school items. As explained above, scale scores were computed only when respondents answered half or more of the items using the 4 or 5 point scale. Respondents who did not use the scale to respond could either skip the item or mark it DK.

An examination of item-level responses revealed that respondents' were relatively more likely to mark DK than skip the school items, about equally likely to mark DK as to skip on the network items, and more likely to do one or the other on network than school items.

When DK was selected as an option, it represented the respondent's explicit indication that they were not aware of the activity in their school or network. At the school level, between 2% and 10% of the responses were DK. At the network level, between 6% and 28% of the responses were DK on the scales. Noteworthy in the network-level responses is that the percentage of DK for Purpose and Focus is 6%, and that this is an exceptionally low percentage as compared to the remainder of the network-level scales. This is an exception in the network-level responses, as the range for the percentage of DK in the other areas shifts to between 18% and 28%. This indicates a marked difference from the school-level scales. The mean percentage of DK responses to the items in each scale is much higher for

the network items than the school-level items. Although they appeared at the end of the survey, the intermediate outcomes and network attachment measures had relatively high response rates. In summary, between 83% and 99% of respondents were assigned valid scale scores for school, intermediate outcome, and network importance scales, while 66% to 94% of respondents had valid scores for network items.

TABLE 1: Respondent-level descriptive statistics and reliabilities for the scales

	Scale	<i>N</i> Items	<i>N</i> Valid	<i>M</i>	<i>SD</i>	Alpha	% DK	
School-level	Purpose & Focus	5	225	4.35	0.50	0.70	2	
	Relationships	11	220	4.01	0.54	0.90	2	
	Collaboration	22	218	3.61	0.58	0.94	5	
	Inquiry	11	207	3.37	0.69	0.92	10	
	Distributed Leadership	16	212	3.49	0.65	0.94	8	
	Accountability	6	216	3.47	0.85	0.85	8	
	Building Capacity	2	214	3.78	0.80	0.64	7	
	Formal Leadership	21	210	4.12	0.62	0.95	4	
	Network-Level	Purpose & Focus	6	214	4.25	0.51	0.74	6
Network-Level	Relationships	11	160	4.08	0.66	0.92	18	
	Collaboration	22	155	3.93	0.68	0.95	25	
	Inquiry	11	148	3.84	0.77	0.92	26	
	Distributed Leadership	16	150	3.84	0.71	0.94	28	
	Accountability	6	153	3.81	0.85	0.84	26	
	Building Capacity	2	153	4.10	0.76	0.72	26	
	Formal Leadership	21	150	4.18	0.68	0.96	23	
	Intermediate Outcomes	Changes in Thinking	12	196	3.37	0.79	0.96	14
	Intermediate Outcomes	Changes in Practice	7	188	3.26	0.86	0.94	15
Network Attachment		1	194	3.12	1.00	na	4	

Note: The % DK shows the mean number, over the items in each scale, who checked the DK option

The means on all of the scales were high. All were above the mid-point of 3. For the Key Features, the highest means were for Purpose and Focus, both for network and school. The lowest were Inquiry, Distributed Leadership, and Accountability for school and network. For most Key Features, means were slightly higher for the network than school measures. Mean responses to the intermediate outcomes and attachment to the network were low in comparison, with the single-item measure of network attachment the lowest of all measures. On the other hand, the mean response of 2.97 to

the 6 items measuring perceived influence of the network on the school was relatively high on the 4-point scale. Cronbach's alpha, a measure of the internal consistency of items making up each scale, was satisfactory or high with the exception of the Building Capacity scales, which had only two items. The remainder of the data analysis was carried out on a data file aggregated to the level of the school.

Table 2 shows school-level correlations between the school and network Key Features and the intermediate outcomes and network affiliation.

TABLE 2. School-level correlations between key features, intermediate outcomes and network affiliation measures

School	Changes in Thinking	Changes in Practice	Attachment to Network
Purpose & Focus	0.37 **	0.37 **	0.28 *
Relationships	0.35 **	0.32 **	0.19
Collaboration	0.40 ***	0.38 ***	0.30 *
Inquiry	0.50 ***	0.49 ***	0.32 **
Distributed Leadership	0.49 ***	0.49 ***	0.43 ***
Accountability	0.37 **	0.35 **	0.30 **
Building Capacity	0.39 ***	0.37 **	0.52 ***
Formal Leadership	0.41 ***	0.43 ***	0.24 *
Network Purpose & Focus	0.45 ***	0.43 ***	0.48 ***
Relationships	0.30 *	0.08	0.15
Collaboration	0.25 *	0.04	-0.05
Inquiry	0.35 ***	0.17	0.06
Distributed Leadership	0.24	0.06	0.08
Accountability	0.10	-0.06	0.09
Building Capacity	0.23	0.05	0.08
Formal Leadership	0.23	0.17	0.11

* p<.05 ** p<.01 *** p<.001 (2-tailed)

Note: the number of schools varied from 62 to 71.

The results presented in Table 2 indicate that correlations are higher overall for the school scales. However, the importance of network Purpose and of network Inquiry to Changes in Thinking is evident. All of the school Key Features relate to Changes in Thinking and Changes in Practice. Schools with higher scores on school Inquiry, Distributed Leadership, Accountability, and Building Capacity tend to have higher self-perceived attachment to the network. The same variables, along with Formal Leadership, are associated with higher perceived influence of the network on the school.

To assess the importance of and high association with the network as reported by network leaders, *t*-tests were used. Table 3 shows the means on all scores of the two groups.

TABLE 3. Descriptive statistics by Level of Association with the Network

School	Network Association				
	Low (N=26)		High (N=42)		
	M	SD	M	SD	
Purpose & Focus	4.29	0.30	4.43	0.42	
Relationships	3.94	0.30	4.09	0.50	
Collaboration	3.45	0.36	3.74	0.51	*
Inquiry	3.15	0.50	3.54	0.64	**
Distributed Leadership	3.43	0.47	3.58	0.62	
Accountability	3.36	0.66	3.57	0.76	
Building Capacity	3.64	0.58	3.90	0.65	
Formal Leadership	4.02	0.45	4.22	0.49	
Network					
Purpose & Focus	4.03	0.47	4.29	0.36	**
Relationships	3.74	0.71	4.06	0.60	
Collaboration	3.62	0.72	3.94	0.58	*
Inquiry	3.58	0.76	3.88	0.64	
Distributed Leadership	3.78	0.60	3.77	0.68	
Accountability	3.75	0.75	3.72	0.80	
Building Capacity	3.97	0.53	4.07	0.75	
Formal Leadership	4.00	0.52	4.25	0.47	*
Intermediate Outcomes					
Changes in Practice	3.05	0.70	3.53	0.54	**
Changes in Thinking	2.93	0.74	3.46	0.63	**
Network Attachment	2.64	0.89	3.21	0.81	**

**p* < .05 ** *p* < .01

The intermediate outcome and network association measures are significantly different between the two groups of schools, which validates the survey measures of these constructs. These results indicate that those schools with a higher association to their networks have a significantly higher mean in their changes in thinking and practice, suggesting network association makes a difference. In addition, school Collaboration and Inquiry and network Purpose and Focus, Collaboration, and Formal Leadership are significantly different between the two groups. Again, in all these cases, the schools with a high association to the network had significantly higher reported means on these Key Features. This distinction offers some insight into the ways in which networks in general and this network in particular have their effects.

WHEN NETWORKS WORK

The theory of action presents a model where schools with high network association can contribute to enhanced student outcomes through the changes in thinking and practice of teachers. Table 3 indicates that the mean score of these intermediate outcomes were significantly higher in schools with high network association. This finding lends support to the importance of network association described in the theory of action. When we examined the results for high leverage Key Features that have strong associations with these intermediate outcomes, we identified four patterns that are particularly worthy of commentary. First, focus is essential; second, collaboration and inquiry combine in a way such that “collaborative inquiry” typifies innovative, knowledge community practices in schools and the network; third, formal leadership creates the conditions for networks to find expression and effect; and finally, that the challenge of making the tacit explicit complicates the “intentional” work of conceptual change that the network promotes. Though we choose to highlight these particular four premises, there is no implication that the other Key Features are not important constituents of successful networked learning.

Purpose and focus

A clearly articulated and supported singular network purpose and focus makes the network difference. The highest correlation between the network variables and the intermediate outcomes was with Purpose and Focus. It correlated significantly with Changes in Thinking (.45) and Changes in Practice (.43). Moreover, it was the only network variable that correlated with the Attachment to Network (.48), suggesting that the purpose and focus of the network is the glue that merged individual interests into a collective one across the network.

In the case of NPBS, there is a single, grounded focus on assessment for learning in the network. This area of focus has been consistent for seven

years. It is designed to support educators in using information effectively to modify and differentiate teaching and learning activities in order to enhance learning opportunities for students. This kind of focus is constructed to circumvent superficial engagement that may result from initial participation in network activity due to extrinsic incentives. Assessment for learning is directly related to the professional work of educators. Hence, their learning, when engaged in focused network activities, proves useful to their practice, thereby likely creating an intrinsic motivation for sincere participation in network activity (Firestone & Pennell, 1997; Katz, Sutherland, & Earl, 2002; 2005). The well-established nature of assessment for learning as a high leverage (in evidentiary terms) element of teacher practice (William, 2006) means that the improvement purpose and focus is sharpened by an explicit awareness of its core components. This established understanding of the benefit and operation of assessment for learning is important because it facilitates intentional capacity building and inquiry within the network to support individuals in their joint work to improve this element of their practice. The salience of this point should not be overlooked because it is the principal hedge against the perennial challenge of networks constantly struggling to hold onto a particular focus while participants want solutions to their current problems (Lieberman, 2004).

We see, then, that the network-level purpose and focus appears to be a high leverage enabler in relation to the intermediate outcomes of changes in thinking and practice. Although these changes are situated at the school level (teachers think and practice differently in schools), school-level purpose and focus did not relate as strongly to the intermediate outcomes. These results suggest that although the network focus concentrates the attention of the individuals, it is collaboration and inquiry as school-level enablers that make the difference. This notion is further supported by the results of the *t*-tests by degree of association indicating that schools with a high network association had higher levels of collaboration and inquiry at the school level (See Table 3). Collaboration and inquiry appeared to be particularly high leverage Key Features at the school-level insofar as connections to the intermediate outcomes of changed thinking and practices are concerned.

Collaborative inquiry

The theory of action posits that individuals span the boundaries between schools and networks either directly or through shared artifacts. When there is a high degree of attachment between the school and the network, the fruits of school-based innovative knowledge communities can spread to other sites. Collaborative practice – in particular forms – grounds both knowledge creation (innovation) and transfer. Research suggests that collaborative practice can allow innovations to spread beyond single sites, build consistent modes of operation (Smith & Wohlstetter, 2001), address tough problems

of teaching (Firestone & Pennell, 1997), build commitment through group understanding (Lieberman & Grolnick, 1996), and solve issues of mutual concern (Wohlstetter & Smith, 2000). Strong knowledge communities are built around teachers who regularly engage in discussions with colleagues about their work. By engaging in extended conversations that place beliefs about learning and teaching under scrutiny, assumptions about practice can be examined and reflected upon in a way that leads to deeper and newer understandings (Bryk et al., 1999; Hudson-Ross, 2001).

The general collaborative practices that were reported in the study were purposeful interactions for problem solving, exchanging information, offering and seeking professional advice, receiving emotional support, and working on joint projects. These kinds of activities are important for cultivating the conditions wherein the kind of critical examination of practice that Warren-Little (1990), Bryk et al. (1999), and Hudson-Ross (2001) describe can occur. Put slightly differently, it is a particular type of collaborative practice that underscores the practices of innovative knowledge communities – collaborative practice that has inquiry at its core.

The other subscales for collaboration in our study had a greater focus on collaborative inquiry. These subscales were the examination of practices (e.g., observing other colleagues in teaching or discussing unsuccessful lessons), making practices explicit (e.g., explain teaching to colleagues), and engaging in productive conflict and allowing for ambiguity (e.g., avoid rushing to decisions in order to avert ambiguity). Given this notion of collaboration, it is noteworthy that schools with a high network association reported a higher degree of collaboration both within the school and between the school and network, than did their low-association counterparts.

The Key Feature dichotomy between schools with high and low network attachment becomes even more robust when “inquiry” is considered. Earlier, we proposed thinking about inquiry as the particular essence of collaboration. Inquiry is the mechanism by which well-functioning social communities of practice can counter and push through the cognitive biases to change their thinking. Little (2003, p. 2) makes references to a large body of research suggesting that:

conditions for improving learning and teaching are strengthened when teachers collectively question ineffective teaching routines, examine new conceptions of teaching and learning, find generative means to acknowledge and respond to difference and conflict, and engage actively in supporting one another's professional growth.

The inquiry processes of questioning, reflecting, seeking alternatives, and weighing consequences (Collinson & Sherrill, 1997; Earl & Katz, 2002, 2006) promote the “face” and “transparency” (Little, 2005) of what otherwise might remain unobservable facets of practice.

In NPBS, assessment for learning is the focus of the network. This focus required teachers to rethink their practice. As a notion, it challenges traditional approaches to classroom practice and sets forth an expectation of questioning current thinking, sharing ideas, and constructing knowledge applicable to the classroom. The nexus of collaboration and inquiry, in the form of collaborative inquiry practices, is established as NPBS educators seek out programs and research to improve learning and practice, systematically analyze data, regularly discuss past events to determine how they worked, learn from failed initiatives, or seek out multiple perspectives.

In collaborative inquiry, members build the working relationship necessary to balance personal support with critical inquiry about present practice and future direction (Borko, 2004; Hudson-Ross, 2001). This allows for the scrutiny of practice within a group without doubting competence or commitment. Moreover, collaborative inquiry practices foster the moderate conflict essential for the development of high joint benefit, while the desire to avoid conflict can undermine this outcome (Engeström, 1999). In our study, NPBS schools with a low network association reported a reduced level of comfort with ambiguity.

In NPBS, we found a significant correlation between network inquiry and changes in thinking, but no correlation with changes in practice; whereas there was a significant correlation between school inquiry and both intermediate outcome variables (Table 2). These results suggest that while teachers may be able to engage in collaborative inquiry practices at the level of ideas in the network, changes in practice are localized in schools where the work of teachers is located.

Leadership

Two kinds of leadership were measured in the survey, formal leadership and distributed leadership. This section will focus on the high leverage function of formal leadership that surfaced from the data. Formal leadership in the network was not correlated to changes in thinking or practice in the data set overall (Table 2). However, when the schools were grouped by level of network association, schools with a high level of association reported a significantly higher level of formal leadership in the network than did their low-association counterparts (Table 3). This is an important difference because the high-association schools did report significantly higher changes in practitioners' thinking and practice.

These analytical results suggest that formal leadership plays a critical role in facilitating the school connection to the network, though it does not directly influence changes in thinking and practice. We submit, however, that strong formal leadership enables practices like collaboration and inquiry to traverse the school and network boundary, thus allowing for the necessary

upload and download function by which networked learning communities have their effect. With respect to formal leadership in the network, we asked questions on the survey about coordinating programs, mediating challenges, providing instrumental support such as resources and flexibility, constructing ways of engaging the faculty and community, and monitoring progress for accountability. Given the focus of these questions, the findings resonate with the literature that describes school leaders as key promoters and supporters of productive collaboration amongst teachers that leads to sustainable improvement and results in increased student achievement (Louis & Miles, 1990).

School leaders are responsible for creating the conditions necessary for teachers to engage in school improvement activities and to feel ownership of the goal of higher student achievement (Peterson, 1994; Togneri & Anderson, 2003). The influence of school leaders on classroom practices is indirect (Witziers, Bosker, & Kruger, 2003). They connect their role to teaching and learning in the classroom through opportunities for knowledge creation which they facilitate for the school as a whole (Silins & Mulford, 2002). In relation to the network, this means that the formal leaders in schools cultivate opportunities for organizational learning in the school through the creation of conditions for collaborative inquiry in the network.

Making the tacit explicit

As mentioned earlier, our research approach was designed to ask practitioners about the work of their colleagues in order to get a sense of the network-related work of the school as a unit. The response options on the survey instrument were constructed on a scale, with an additional category of “Don’t Know” (DK). This additional option offered the practitioners answering the survey – respondents who were purposefully selected by their network and school leaders as the most knowledgeable faculty in the school about network activities – to indicate that they were not knowledgeable about a particular school practice.

The distribution of the way in which the respondents employed “Don’t Know” was informative and suggests that there is a degree of obscurity to certain practices. At the network level, with the exception of Purpose and Focus, the average percentage of DK on all the Key Features was approximately 25%. At the school level, the Key Feature items that resulted in the highest percentage of DK (10%) were in Inquiry. The notable difference in the respondents indicating a lack of awareness about school-linked network practices versus straight school practices is intuitively understandable. The visible face of school improvement is localized in the school not the network, and that difference in location is reflected in the different levels of awareness illustrated in the data. That said, making the tacit explicit is a key prerequisite to what psychologists call conceptual change – the kinds

of changes that push beyond the confirmation and conservation biases, and result in the creation of new knowledge, thinking, and practice.

The theory of action suggests that the promise of networked learning communities rests with their connection to schools such that the practices associated with innovation knowledge communities can be cultivated, uploaded, and downloaded. It is a process that resonates with our best understanding of sustainable professional learning that has depth of understanding for educators. Teachers acquire competencies in their workplace setting where new practices emerge (Hargreaves, 1997; Knight, 2002). The workplace setting for professional learning can encompass the classroom, the school, or extend to partnerships with internal or external communities. Learning occurs when teachers actively engage in their role, which implies that teachers learn throughout their daily activities (McLaughlin, 1997). Even when teachers develop all of the different kinds of knowledge for teaching, the application of this knowledge must occur in the classroom. Positioning individual learning within communities of practice has shown promise in promoting knowledge development and its application through everything from problem solving, to sharing, to joint work.

The theory of action encapsulates this form of professional learning for deep and sustainable change. The results of the survey, however, indicate that there is a degree of obscurity in teachers capturing the changes in thinking and practice of their school colleagues. Fifteen percent of respondents did not know if their colleagues experienced changes in their thinking or practice. These results suggest that there is an imperceptible quality to these intermediate outcomes. Teachers do not open their thinking and practice to scrutiny as they ideally would in an inquiry-based culture. Yet this transparency is necessary if the “doings” of network activities are to translate into changes in school practices thereby leading to increased student achievement.

CONCLUSION

In ever growing numbers, policy makers and educators are relying on the intuitively and empirically supported idea that new learning occurs in social settings. With this in mind, they work in more or less structured ways within the social organization of more formally or informally established networks, hoping to create conditions whereby new learning leads to improved student achievement. The various successes or failures of different networks, however, have heretofore been examined largely as discrete occurrences, with no theory of action to guide researchers as they attempt to understand how networks function. The research presented in this paper is a response to this need for deeper understanding.

This work has presented networks as collaborative systems that support particular ways of working and find expression within two distinct organizational

units – the network itself and its participant schools. The typical assumption embedded within the establishment of school networks has been that new learning will occur and transfer across the system, change thinking and practice, and yield higher student achievement. As demonstrated through the application of our theory of action to the Network of Performance Based Schools, the likelihood of such learning can be intentionally supported through consideration of the seven Key Feature enablers in particular ways.

While certain Key Features are shown here to work with greater amounts of leverage (Focus and Purpose, Collaboration, Inquiry, and Formal Leadership), it is the interaction and interdependence of all Key Features that creates the conditions conducive to overall network success. Of particular note to researchers, policy makers, and educators is the challenge posed by the tacit nature or invisibility of practice inherent within teaching. With this in mind, explicit, conscious, and intentional strategies to support teachers in examining, understanding, and sharing practice within schools and across networks must be undertaken in order to help networks contribute to the cultivation of innovative knowledge communities.

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