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School Effectiveness and School Improvement: An International Journal of Research, Policy and Practice
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/nses20

Organizational considerations in establishing the Data-Informed District

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Available online: 04 Apr 2012

To cite this article: Jeffrey C. Wayman, Jo Beth Jimerson & Vincent Cho (2012): Organizational considerations in establishing the Data-Informed District, School Effectiveness and School Improvement: An International Journal of Research, Policy and Practice, 23:2, 159-178

To link to this article: http://dx.doi.org/10.1080/09243453.2011.652124

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School Effectiveness and School Improvement
Vol. 23, No. 2, June 2012, 159–178

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In the United States, effective data use is proving to be a vexing problem. In response, scholars have recently begun viewing this as a systemic problem, believing there are actions a school district may take to make data use more efficient and tenable throughout the organization. In this article, we add to the knowledge of how school organizations can more effectively use data for educational improvement. Through the lens of the Data-Informed District, we leverage the research on organizational improvement and data use to discuss 3 specific organizational areas in which these districts may improve: establishing common understandings, professional learning for using data, and computer data systems.

Keywords: data-driven decision making; districts; computer data systems; professional learning

Introduction

In the USA, districts, schools, and educators have been given a difficult charge: take the abundance of school data generated each year and turn it into information that can help improve educational practice. While policy structures implicitly assume this happens as a consequence of sanctions, it is a complex and difficult undertaking, partly because many different actors and levels are present in American educational systems.

American school districts are multifaceted learning organizations where many levels, factors, and actors have direct and indirect effects on the education of children. Most schools are part of a larger educational organization called a "district". School districts typically have an upper level of organization called the "central office", which consists of a district leader (a "superintendent") and other district administrators who support and direct the various schools. The leader of each school is called a "principal", and this leader is responsible for other building-level administrators such as assistant principals, and building-level staff such as counselors, administrative assistants, and teachers. It is at the building (or "campus") that education happens directly. Most district employees are located at the building level.

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ISSN 0924-3453 print/ISSN 1744-5124 online
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http://dx.doi.org/10.1080/09243453.2011.652124
http://www.tandfonline.com

Much of the research base on educational data use has isolated specific aspects of the district, such as teachers (Ingram, Louis, & Schroeder, 2004; Lachat & Smith, 2005; Schildkamp & Kuiper, 2010; Wayman & Stringfield, 2006; Young, 2006), principals (Copland, 2003; Deike, 2009; Wayman, Brewer, & Stringfield, 2009), and central office (Farley-Ripple, 2008; Honig & Coburn, 2008; Moll, 2009). Additionally, scholars are studying ways that various aspects of the district intertwine to affect data use throughout the educational organization. In studying data use systemically, these scholars examine how various components of a school district work together in using data such that the entire district is a more coherent, data-using organization. Knowledge from these studies suggests that integrated, district-wide data use can be better realized by aligning vision, practice, and data (Kerr, Marsh, Ikemoto, Darilek, & Barney, 2006; Louis et al., 2010; Supovitz & Klein, 2003; Wayman, Cho, & Johnston, 2007; Wohlstetter, Datnow, & Park, 2008), integrating focus on leadership at various levels (Halverson, Prichett, Grigg, & Thomas, 2005; Mandinach, Honey, Light, & Brunner, 2008; Supovitz, 2006; Wayman et al., 2007), efficiently incorporating technology (Long, Rivas, Light, & Mandinach, 2008; Wayman et al., 2007), and paying attention to staff support (Datnow, Park, & Wohlstetter, 2007; Louis et al., 2010; Supovitz & Klein, 2003; Wayman et al., 2007).

Still, there is much to be learned about how school districts may make better use of data throughout the organization. In this article, our goal is to add to this body of research by outlining the organizational considerations we have considered in helping three school districts improve their data use. Our lens for synthesizing this information will be the Data-Informed District (Wayman, Cho, Jimerson, & Snodgrass Rangel, 2010; Wayman et al., 2007). In the following section, we describe a research project currently underway that studies the Data-Informed District.

Our perspective: the Data-Informed District

We are in the midst of a 3-year project designed to help three school districts improve their use of data by employing a systemic focus we call the *Data-Informed District* (Wayman, 2010; Wayman, Cho, Jimerson, et al., 2010; Wayman et al., 2007). For this project, our definition of "data" is broad and encompassing, including any information that helps an educator know more about their students (e.g., tests, quizzes, formal assessments, student background data). In our view, integration and collaboration characterize the use of data in such a district. Educators in a Data-Informed District would be adept at tailoring and adapting their practices appropriately because they would benefit from district-sponsored support in this area to capitalize on their most important resource: their professional judgment. Perhaps most important, educators in a Data-Informed District would use data *in the course of* their regular work, not *in addition to* their regular work.

As part of this project, we have conducted thorough evaluations of each district's uses of data. We provided each district a comprehensive report that contained our findings and detailed recommendations on how they can improve data use district-wide. An example report is offered by Wayman, Snodgrass Rangel, Jimerson, and Cho (2010), and a summary of the three reports was presented by Wayman, Cho, Jimerson, et al. (2010). We are currently working with each district to implement these recommendations and better understand systemic effects on using data.

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In these evaluations, we found that data use was a difficult endeavor for educators in all three districts. While this touched many areas and functions, three areas stood out as needing immediate attention in all three districts.

First, there existed very little common understanding in our districts about teaching, learning, or the service of data. This was not for lack of effort – at the upper levels of each district, efforts had been made to create vision or mission statements about teaching and learning. Even so, each of our districts had been unsuccessful in communicating these statements authentically throughout the district and helping educators connect to these statements. This lack of commonality made it hard for educators to share work or knowledge. Thus, it was clear that each district needed to work toward common understandings about how data could support teaching and learning.

Second, our districts faced challenges in designing and implementing data-related learning opportunities for campus administrators and teachers. Our evaluations indicated that some opportunities existed, but rarely were they differentiated to meet the needs of individual educators. Further, no district offered sufficient structured time for learning how to use data. As a result, we endeavored to work with our districts on appropriate methods to deliver effective, relevant learning opportunities that helped their educators use data.

Third, the state of computer data systems was a clear hindrance to effective data use in each district. Each district lacked an integrated data system, so educators who used data had to cobble it together from a variety of stand-alone systems. Further, the systems they did use were often described as unfriendly and cumbersome. In light of these results, we saw the need to help our districts implement data systems that could afford easy, integrated access to the data their educators needed.

Statement of the problem

Problems with common understandings, professional learning, and computer data systems were hindering our districts as they attempted to better use data throughout their districts. As per our role in the partnership, we offered our districts a research-supported, systemically based response to these problems.

Solving these problems has been elusive not just for our districts but for others as well (e.g., Lachat & Smith; 2005; Supovitz & Klein, 2003; Wayman et al., 2007; Wayman & Stringfield, 2006). Since these problems are occurring in many districts, we can contribute to the field by reviewing the literature that informed the solutions we offered our districts.

Consequently, the aim of this article is to discuss organizational considerations that can help districts move toward becoming more data-informed learning organizations: "Data Informed Districts". In doing so, we will lay out the research that supports these approaches, drawing upon literature from the study of organizational learning, educational change, knowledge management, and educational data use to elucidate potential solutions to these problems. Such a review should help any district looking to improve how data are used to improve educational practice.

Improving data use district-wide: important organizational considerations

The systemic perspective on educational data use is providing new insights into how districts, schools, and educators may make better use of their data. Nonetheless,

there is ample room to delve more deeply into various forms of organizational research to expand understanding of steps that school systems can take to make data use more effective throughout the district.

Our previous work (Wayman, Cho, Jimerson, et al., 2010) suggested three areas for focus: common understandings, professional learning, and computer data systems. In this article, we will restrict our focus to these three areas, acknowledging that there are other areas that could benefit from such a review. The following three sections describe our understanding of issues pertinent to each specific area.

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Common understandings

The presence of common understandings about educational goals and practices can be an important aspect of organizational improvement. Scholars have discussed common understandings in various ways, including internal consistency (Elmore, 2003), shared organizational vision (e.g., Senge, 2006), and clearly articulated, shared goals (e.g., Datnow & Stringfield, 2000; Spillane & Louis, 2002; Stringfield & Datnow, 2002). Specific to educational data use, researchers have found that the use of data is more effective when educators can envision the ways in which data use is linked to these broader systemic aims. For example, Wayman and Stringfield (2006) and Wohlstetter et al. (2008) describe how data can help establish a consistent language among educators, affording richer common ground for discussing issues like grades, expectations, and student needs. Some have found that such understandings may be developed implicitly via collaborative work (Lachat & Smith, 2005; Spillane & Louis, 2002; Wayman, Midgley, & Stringfield, 2006).

We have suggested in prior work (Wayman et al., 2007) that districts should be intentional and explicit in building common understandings. However, we also recognize that the work to build common understandings goes beyond merely articulating goals, plans, or policies; such statements are only one stepping stone toward organizational improvement. Equally important, these plans, policies, and articulated agreements are subject to interpretation and local adaptation (Levinthal & Warglien, 1999; O'Day, 2002; Park & Datnow, 2009; Spillane, Reiser, & Reimer, 2002; Weick, 1976). Actors adjust their activities based upon situational dynamics and information that may be difficult to predict or capture on paper. Accordingly, we see the work of building common understandings as affording a benefit besides mere articulation of goals: This work also can foster meaningful conversations about teaching, learning, and data use that can serve as a way to pool expertise and strengthen relationships. In this way, districts can support how people come to interpret, communicate about, and adapt their work toward organizational goals.

We conceptualize common understandings about data use as shared meanings, perceptions, and definitions around teaching, learning, and the service of data for each. We envision districts rooting such efforts in collegial conversations, in ways that are inclusive and that build the capacity of not only individual participants but of the organization as a whole. With this in mind, we will discuss four important considerations when working toward common understandings: (1) Working collectively, (2) Valuing the process, (3) Allowing for self-determination, and (4) Continuing the work.

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Working collectively

Districts' efforts to develop common understandings should be inclusive of as many district members as possible. In inviting widespread participation, districts may develop richer and more commonly shared senses of purpose, commitment, and connectivity. Senge (2006) describes shared vision in terms of deeply held values and mental models, tying people together in creating a shared future. If districts are to unearth the things that matter most to a district's shared vision, we see such processes as necessarily being inclusive of people from throughout the district.

In addition, working together to clarify the how and why of what we do with data can foster commitment to data initiatives. For example, the ability to advertise "who we are" to those outside of the organization may bolster external support and a sense of legitimacy (Stone & Brush, 1996). Internally, a sense of commitment may also be developed by the sense of having contributed to organizational decision making. Langley et al. (2009) indicate that inviting and taking into account feedback from the persons affected in any change process can support commitment to the change in question. Similarly, Hirschman (1970) describes how having a voice in decisions can strengthen loyalty and commitment to change, lessening the likelihood that people will abandon organizational goals.

Perhaps equally important, the connectivity and relationships developed by working collectively can serve as an additional resource for organizational change. Organizations that place stock too heavily in predetermined goals, roles, and routines may find themselves limited when demands become complex, unfamiliar, or ambiguous (Brown & Duguid, 1991; Morgan, 1986; Weick, 1976). Relationships help people to make sense of their environments; so even when actors do not have a say in, do not agree with, or do not understand a decision, they may be willing to act as if they do (Eisenhardt, 1990; Weick, 1993; Weick & Roberts, 1993). In essence, working together toward common understandings helps provide actors with stronger interconnections about how to organize in the face of adverse or uncertain conditions.

Valuing the process

Working toward common understandings is a process. We see opportunities to work collectively on problems (and to strengthen or form collegial relationships) as an important aspect of organizational learning (Brown & Duguid, 1991; Davenport & Prusak, 1998; Nonaka, 1994; Senge, 2006; Supovitz, 2010). Thus, districts may find it effective to focus on the value of the process rather than the outcome. In this sense, coming to articulate common understandings may be better likened to a continuing dialogue (Senge, 2006), rather than simply arriving at consensus.

We recognize that many organizational theorists and experts advocate the establishment of clear, articulated goals that can guide organizational efforts (e.g., Datnow & Stringfield, 2000; Langley et al., 2009; Senge, 2006; Stringfield & Datnow, 2002). Further, the data-use literature has been nearly unanimous in similarly advocating for clear, articulated goals (e.g., Boudett, City, & Murnane, 2005; Lachat & Smith, 2005; Louis et al., 2010; Supovitz & Klein, 2003; Wayman & Stringfield, 2006; Wohlstetter et al., 2008). We do not interpret this literature to find that specific, lockstep detail is beneficial to the organization. Instead, it is the combination of broad goals and working together that bring the most benefit: Broad goals help people to move in the same direction toward a common purpose

(e.g., Langley et al., 2009; Senge, 2006), while working collectively helps unearth the beliefs and understandings that shape interpretation and adaptation in practice (Brown & Duguid, 1991; Carlile, 2002; Davenport & Prusak, 1998; Louis, 2007; Park & Datnow, 2009). Thus, what matters about working together to articulate common understandings may rest more on the processes and conversations that give rise to these understandings than on their granular detail. It is not about having the right chart, data system, or interlocutor. Rather, it is about adopting the attitude that the organization is smarter as a whole when its individual members continually sustain efforts to understand and support each other's work.

We must note that effecting this process may be complex because educators in different roles (e.g., teacher or central office) may speak different "languages". Building upon observations that knowledge is often localized, invested, and embedded in practice, Carlile (2002) describes how such a process can enhance collaboration among those of similar job roles, but also may create knowledge boundaries between those of dissimilar roles. Some work (e.g., Honig, 2006) indicates that knowledge boundaries may be solved through people who act as boundary spanners, linking disparate perspectives. Others (e.g., Carlile, 2002) note that objects can serve this purpose because they offer participants a structure for sharing their assumptions and expertise, thus producing a new, shared language. In our interpretation, the process can make use of both types of "spanners", but we again stress that it is the conversations are important.

Allow for self-determination

A growing body of literature suggests that despite clear goals and attempts to communicate policies or strategies, actors have their own interpretations and strategies for accomplishing goals or changes (e.g., Langley et al., 2009; O'Day, 2002; Rivkin & Siggelkow, 2002; Spillane, 1998). Thus, what actually becomes of policy can be seen as flexible, multidirectional, and co-constructed (Datnow, 2006; Park & Datnow, 2009). We see this variation as a positive in working toward common understandings.

In applying this view of organizations, we suggest that differences among actors can be a source of innovation and strength. If it is seen as natural that people may discern for themselves what is appropriate and how to adjust, then these innovations may also be seen as an important organizational resource (Brown & Duguid, 1991; Davenport, 2005; Morgan, 1986; Weick, 1976). We see engaging in ongoing dialogue that seeks to build and articulate common understandings as a powerful way to generate new ways of seeing problems, to share insights learned elsewhere, and to smooth out the values, knowledge, and expertise that shape interpretations.

We suggest that through the process of attempting to establish common understandings, organizations explicitly recognize and embrace the creativity that comes from diverse perspectives being brought to the dialogue. O'Day noted this as a need for "balance between encouraging consistency while allowing for diversity of thought and practice" (2002, p. 298). In terms of data use, this acceptance of a bounded range of policy interpretation is evident in admonishments to mandate the "what" but not the "how" (Wayman et al., 2006). The trick is to find the balance between lessened variation (to eliminate interpretations that are wild outliers or which are counter to the purpose of the organization) and *no* variation (in which case creativity is quashed and the organization stagnates). We see engaging in ongoing

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dialogue that seeks to build and articulate common understandings as a powerful strategy to finding and maintaining such a balance.

Continuing the work

One reason we place such high priority on districts "valuing the process" is that this work is never complete. In broader organizational literature, reinforcing and clarifying processes are considered essential (Argyris & Schön, 1996; Langley et al., 2009; Senge, 2006; Supovitz, 2010). In fact, Senge notes that "visions spread because of a reinforcing process of increasing clarity, enthusiasm, communication, and commitment. As people talk, the vision grows clearer. As it grows clearer, enthusiasm for its benefits builds" (2006, p. 208). The work of effective data use is similar: As educators work together to build common understandings for data use, participants gain not only clarity but motivation for the next step.

In addition, we noted in the previous section that human beings will inevitably come to any table with a diversity of perspectives and opinions. Such diversity necessitates continual engagement to shape and reshape how the work of data use is done. Too, in the reality of schools (as well as any organization), turnover is inevitable. As individuals enter and exit the system, existing core agreements or commitments to a particular organizational approach can be eroded (Datnow & Stringfield, 2000; Fullan, 2007; O'Day, 2002). Consequently, it is important that districts never stop honing, shaping, and updating their common understandings about how data will be used to help teaching and learning.

Professional learning

Knapp (2003) defines *professional learning* as "changes in the thinking, knowledge, skills, and approaches to instruction that form practicing teachers' or administrators' repertoire" (pp. 112–113). This and other research (e.g., Borko, 2004; Desimone, Porter, Garet, Yoon, & Birman, 2002; Elmore, 2004; Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009) suggests that effective professional learning for data use supports increases in educator learning and serves as a catalyst for lasting changes in practice.

We conceptualize professional learning for data use as a socially based endeavor that is daily, ongoing, and dynamic. Consistent with more general work on professional learning (e.g., Guskey, 1989; Knapp, 2003; Wei et al., 2009; Yates, 2007), our stance is that teacher capacity for using data will be better built if teachers participate in frequent learning opportunities that allow them quickly to try out new skills and knowledge.

This approach should not only make individual learning more effective but should improve knowledge-sharing among clusters of educators (e.g., interdisciplinary or grade-level teams, campuses, district departments). However, we also recognize that for professional learning opportunities to live up to the potential we envision, professional learning supports need to attend to certain characteristics so that learning may be linked to practice in useful, coherent ways (e.g., Desimone et al., 2002; Guskey, 2009; Knapp, 2003; Yates, 2007; Yoon, Duncan, Lee, Scarloss, & Shapley, 2009). Consequently, we conceptualize professional learning as being supported by activities that are (1) job-embedded, (2) collaborative, and (3) small. In the following sections, we explore what we mean by each of these. School

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organizations that attend to each will be well positioned to support the ability of the organization to engage in systemic data use.

Job-embedded approaches to professional learning

Research has found that educators are frustrated with the time that "one-size-fits-all" training takes from their workdays (Wayman, Cho, Jimerson, et al., 2010; Wayman et al., 2007; Wayman, Cho, & Shaw, 2009). Understandably, educators particularly chafe at tasks which take away from their everyday educational duties while not contributing to the ability to do them better. Accordingly, we see a need to make data-related learning more substantive and more compatible with daily activity.

One solution to this challenge is to infuse professional learning into the everyday work of educators. In these "job-embedded" structures, professional learning takes place within the context of daily routines and tasks in which educators are already engaged (e.g., grading, participating in parent conferences, or lesson planning). This definition is consistent with other uses of the "job embedded" throughout the literature (e.g., DuFour, Eaker, & DuFour, 2005; Elmore, 2004; Guskey & Yoon, 2009; Spillane & Louis, 2002; Wei et al., 2009). We interpret the literature to suggest that there are nuances of embeddedness. We see professional learning for data use as embedded in: (1) the physical and temporal parameters of the educator's *workday*, (2) the *content* of an educator's job task, and (3) the *relationships* that create the context in which educators go about their work.

Workday embedded. Fullan (2007) asserted that the majority of teacher learning must happen in the context of everyday work, and others have adopted a similar approach (e.g., Borko, 2004; Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; Spillane & Louis, 2002). In a similar vein, data-related learning opportunities should be frequent and situated as much as practical within the parameters of the regular workday.

This approach also fits the way educators work. Educators have been shown to be frustrated with learning structures that required that they leave their classrooms for long periods of time (Wayman, Cho, Jimerson, et al., 2010; Wayman et al., 2007). These findings dovetail with those of Gallucci (2008), who noted a decrease in teacher resistance to participating in professional development when the learning happened in their classroom contexts. Other research also bears out this finding: Wayman, Cho, and Shaw (2009) noted that when a district did *not* embed data use and associated learning opportunities in the regular workday, the additional work created resulted in teachers opting out of participation entirely.

Experts in organizational learning (e.g., Argyris & Schön, 1996; Senge, 2006) frequently address the importance of timely reinforcing or corrective feedback to a learning organization. Without timely feedback, organizations may make decisions on outdated information (Argyris & Schön, 1996; Senge, 2006). Other scholars have linked this literature to the individual context in education. For instance, Fullan asserts that teachers need the support to "constantly test out, refine, and get feedback on the improvements they make" as a result of professional learning (2007, p. 297). We also know from the work of Guskey (1989, 2002) that providing these types of incremental, looping structures in support of learning is critical because teachers tend to maintain changes in practice only when they have evidence that the

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change has resulted in improved outcomes. Workday embedded professional learning permits new learning to be tried out *in situ*; in essence, it truncates the time between learning a new data-use skill, trying that skill on the job, and drawing initial conclusions about the effectiveness of the change in practice.

Content embedded. Research routinely reports that professional development is effective in leveraging changes in practice when it connects directly to the subject matter taught (e.g., Borko, 2004; Desimone et al., 2002; Elmore, 2004; Garet, Porter, Desimone, Birman, & Yoon, 2001). Elmore (2004) asserted that "... improvement is more a function of learning to *do the right thing in the setting where you work*" (p. 73). Thus, it is important to provide a variety of opportunities that embed professional learning activities within the specific content for which an educator is responsible. For example, it may be serviceable (i.e., easy) for a math teacher to learn about data use at a general workshop, but it is better for that teacher to learn how to use data relevant to the math content they are teaching and about the scope, sequence, and skills involved in connection with particular math content.

Relationship embedded. Research consistently shows that educators benefit from opportunities to learn from and with each other (e.g., Borko, 2004; Desimone et al., 2002; Fullan, 2007; Newmann, King, & Youngs, 2000; Wei et al., 2009). Teachers and administrators routinely attest to the value of working with their colleagues to generate and share knowledge relevant to student learning (Datnow et al., 2007; Lachat & Smith, 2005; Wayman & Stringfield, 2006). We therefore recommend that districts build data-related learning opportunities into relationship-supportive structures (e.g., grade-level teams, student-support teams). We see this as an opportunity to both "feed" these existing structures with new learning and new information and to strengthen relationships by engaging educators in purposeful, student-oriented work.

We envision many different types of connections that can enable a diversity of relationships and opportunities to share knowledge. In a school context, there may be many structures along the spectrum from informal (e.g., "watercooler" conversations) to formal (e.g., classes, workshops) that can work to both equip teachers for better data use and build expertise into social networks. Such connections likely run the gamut from Professional Learning Communities (e.g., DuFour et al., 2005; Fullan, 2007) to mentorships and apprenticeships (Lave & Wenger, 1991). This perspective is consistent with organizational research (e.g., Brown & Duguid, 1991; Nonaka, Umemoto, & Sasaki, 1998; Senge, 2006) that asserts the importance of facilitating multiple ways to pool and share expertise throughout the organization.

Specific to data use, this phenomenon of socially supported learning was described by Wayman, Cho, and Shaw (2009), who noted that successful data-using teachers had created their own ad-hoc groups to learn about and continually improve on data use. Other work has detailed the use of data coaches or other job roles focused on *in situ* coaching (Boudett et al., 2005; Lachat & Smith, 2005). These "go-to" persons support immediate learning about data use in the context of the classroom or administrative office. The bottom line is that districts can create learning structures that support constructive relationships while leveraging improved data use through those same relationships.

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Collaborative approaches to professional learning

Research consistently attests to the importance of collaboration as a critical attribute of successful professional learning (e.g., Garet et al., 2001; Wei et al., 2009; Yates, 2007). While the positive effects of collaboration are likewise well established in the data-use literature (e.g., Kerr et al., 2006; Lachat & Smith, 2005; Schildkamp & Kuiper, 2010; Wayman & Stringfield, 2006), the link between collaboration and learning how to use data is just beginning to emerge.

Recent research suggests that as educators engage in learning together, they are more apt to implement and maintain changes in practice (e.g., Borko, 2004; Desimone et al., 2002; Wei et al., 2009). Louis (2007) pointed out that collaborative work can support trust-building among teachers and administrators. Fullan (2007) writes about the positive peer pressure that can be realized in "pressuring and supporting" change processes. Peer norming has also been observed at work in how data were used, received, and discussed by teachers (Park & Datnow, 2009; Young, 2006). Thus, positive forms of peer pressure and support may be instrumental in helping teachers change their practice based on what they learn from student data.

Literature on organizational learning evidences that connecting people who speak from diverse perspectives, experiences, and job roles is essential to the health and effectiveness of the organization (Brown & Duguid, 1991; Carlile, 2002; Louis, 2007; Nonaka et al., 1998; Senge, 2006). Our position is that professional learning for data use does not have to flow from an expert but only needs to include persons with a level of expertise. This is playing out in the data-use literature: While experts have been shown to be helpful supports (e.g., Boudett et al., 2005; Lachat & Smith, 2005), many other descriptions of successful collaboration have simply included educators interested in learning more and getting better at data use engaging with peers and colleagues whose skill set was slightly more advanced (e.g., Wayman, Cho, & Shaw, 2009; Wayman & Stringfield, 2006; Young, 2006).

It is important to note that district actors cannot assume that collaboration around data will happen, or that, when it does, the outcomes will always be positive. As Fullan (2007) notes:

> ... it is not collaboration per se that counts. Collaboration is powerful, which means that people can do powerfully wrong things together. ... Collaboration makes a positive difference only when it is focused on student performance for all and on the associated innovative practices that can make improvement happen for previously disengaged students. (p. 285)

We read this as a call for districts to provide structured supports that foment positive collaboration aimed at improved student outcomes. Again, this is in line with research emerging from the field of data use. Wayman et al. (2007) suggested that systemic structures be put in place to provide educators the time and direction needed to engage in quality collaboration around data. These structures can be formal or may inhere within informal practices (Wayman, Brewer, & Stringfield, 2009). However, we caution, as do Wayman, Brewer, and Stringfield (2009), that districts should not depend on informal collaboration practices, as these may prove unsustainable over time with personnel and organizational changes.

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Small approaches to professional learning

Professional learning structures are frequently large-scale, workshop-like productions. Such formats can provide a convenient opportunity to disseminate information throughout an organization. And, as Guskey and Yoon (2009) point out, such sessions are not always poor vehicles for learning: What is important is what happens *within* and *after* the session. Additionally, research indicates that learners must be actively engaged, should participate collaboratively, and be able to link new learning to specific job content (e.g., Borko, 2004; Desimone et al., 2002; Ingvarson, Meiers, & Beavis, 2005; Knapp, 2003; Yates, 2007).

Viewing this research body as a whole, we believe that much of what needs to be done to support educators in learning to use data better is more tenable within "small" structures. By "small", we mean a limited numbers of persons involved in any particular session (e.g., grade-level or interdisciplinary teams, feeder pattern administrators), learning sessions that can be completed within a brief amount of time (from a few minutes to a conference period), and targeted sessions that aim to equip educators with one or a few new data-use skills.

This approach aims at enabling those elements of professional learning found to support changes in practice (e.g., active learning, collaboration, job embeddedness, a focus on job content) in ways that allow educators to immediately try out new skills or knowledge in context – something that research indicates is critical in supporting long-term changes in practice (Borko, 2004; Elmore, 2004; Guskey, 1989, 2002). This approach may be identified as "incremental" (e.g., Guskey, 1989, 2002) in that it gradually builds related data-use skills. We also see this as responsive to research that addresses "coherence", or of learning experiences relating both to prior learning opportunities and to the goals of the organization (e.g., Desimone et al., 2002; Ingvarson et al., 2005; Penuel, Fishman, Yamaguchi, & Gallagher, 2007). Further, a "small" approach to professional learning makes use of the social nature of learning: Educators will more actively engage with colleagues in small groups meeting frequently, as opposed to large group settings. Teachers report that these attributes – so often noted as essential to supporting learning and change in practice – are rare in the context of large-scale professional development sessions (Wayman, Cho, Jimerson, et al., 2010; Wayman, Cho, & Shaw, 2009; Wayman et al., 2007).

Organizationally, creating and maintaining conduits for knowledge sharing among actors can improve how knowledge flows into and through the organization (Senge, 2006). It also provides new avenues for feedback on how and whether structures and processes are working as intended (Nonaka et al., 1998; Senge, 2006). A small approach, because it can happen frequently, provides timely feedback that can support the revision and improvement of practice. Still, we offer a caution to districts looking to implement a small-scale approach to professional learning. Research is consistent that the most effective learning occurs when programs of learning are linked and enable educators to build knowledge and skills from one session to the next – that they are *coherent* (Desimone et al., 2002; Garet et al., 2001; Knapp, 2003; Penuel et al., 2007; Yates, 2007). However, research is also emerging educators are responsive to learning structures that are intense in terms of *time*, meaning the learning continues across a span of time and/or aggregates to numerous hours of learning and trial (Garet et al., 2001; Ingvarson et al., 2005; Supovitz & Turner, 2000; Yoon et al., 2007). This suggests that even a "small" approach needs to be focused and cumulative: It cannot be haphazard but should be well planned so that there is a clear direction for learning about data use.

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Computer data systems

Computer data systems offer unprecedented capacities for storing, integrating, analyzing, and sharing data. Further, these capacities have only become more remarkable as technological developments have marched on. Wayman and colleagues have identified major system types and characteristics of systems that may be important to data use (e.g., Wayman, 2007; Wayman, Cho, & Richards, 2010; Wayman, Stringfield, & Yakimowski, 2004). With today's systems, educators have the potential to access data as far reaching as a student's entire academic history at schools throughout a district or as up-to-the-minute as the latest in-class assignment or discipline infraction. Often, this access can come in just a few clicks of the computer, without requiring traditional data entry or calculations from teachers. It is no longer necessary, or perhaps even sensible, for educators to invest hours or days in entering their own data into spreadsheets or in creating elaborate displays on office walls out of last year's data just to get a sense of student or class needs.

Indeed, districts face mounting pressures, both internally and externally, to adopt computer data systems (Burch & Hayes, 2009; Means, Padilla, DeBarger, & Bakia, 2009). Equally important, the effects of data systems on educator's work are not always evident to districts before they embark on adopting such systems. In what follows, we detail three aspects to effective data system implementation and how they may contribute to organizational improvement: (1) Integrated, centrally supported systems; (2) Widespread, easy access; and (3) Collegial relationships.

Integrated, centrally supported systems

On the surface, the potential benefits of computer data systems seem to revolve around their functionalities and potential to offer easy access to data. Looking beyond these advantages, however, is the potential for these systems to help districts become stronger learning organizations. Accordingly, it is important that districts implement systems that are both integrated and centrally supported.

One characteristic of learning organizations is the timely use of appropriate information (Argyris & Schön, 1996; Senge 2006). Computer data systems do much to advance districts' integration of data. They offer more data and more powerful analyses, in more timely ways, than ever before (e.g., Mieles & Foley, 2005; Wayman, Cho, & Richards, 2010; Wayman et al., 2004). Additionally, access to data systems has become increasingly mobile, and systems are increasingly better at linking disparate types of information (Wayman, Cho, & Richards, 2010) – functionalities that are almost ubiquitous in our everyday lives outside of schools. Unfortunately, most districts have not taken advantage of this potential (Means et al., 2009). This lag between what is and what could be is not lost on educators themselves, as research reports that educators continue to wish their data were more integrated and accessible in one place (Means et al., 2009; Wayman, Cho, Jimerson, et al., 2010; Wayman et al., 2007).

Equally important, centrally supported systems have the potential to connect educator to educator, as well as campus to campus, or campus to central office. These connections are critical to organizational improvement – knowledge serves as an important resource but also exists in different places in the organization at different times (Boisot & Cox, 1999; Davenport, 2005; Markus & Robey, 1998; Mata, Fuerst, & Barney, 2001; Wade & Hulland, 2004). Technologies (such as data systems) are important in helping to preserve and redistribute that knowledge (Alavi

& Leidner, 2001; Nonaka et al., 1998; Swan, 2009). To this end, integrated systems enable educators to attend to student needs where others have left off, even when students change schools (Wayman, Conoly, Gasko, & Stringfield, 2008). This takes data systems out of the realm of merely storing and delivering data, and into one where educators better create a more comprehensive net around students. Again, we stress that this vision is far from reality in many districts: In the absence of a centrally supported system, educators have reported challenges associated with information bottlenecks, silos among departments, and inaccuracies in data (Means et al., 2009; Wayman et al., 2007).

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Widespread, easy access

Of course, the benefits described above are impossible if districts fail to provide educators with access to a data system. Data use can be stifled when educators do not have time to access and explore data (Ingram et al., 2004; Means et al., 2009; Wayman, Cho, & Shaw, 2009) or when barriers exist to getting the data they need (Lachat & Smith, 2005; Schildkamp & Kuiper, 2010; Shen & Cooley, 2008).

Such limitations on individuals can have organizational effects. In many ways, systemic capacity for improvement begins with individual capacity (Elmore, 2004; Fullan, 2007; Senge, 2006). When access to integrated data systems is widespread, individuals are better able to process and be sensitive to student needs. To illustrate the notion of sensitivity, Weick (1976) compares members of organizations to elements of sand. Set to the task of displaying wind currents, sand is better than, say, rocks. Each independent element of sand does a better job of sensing its environment. While this image can be useful, one's understanding of systemic capacity can be furthered by seeing organizations as networks of people who not only sense but also process information about and act upon their worlds (Levinthal & Warglien, 1999; Macguire, McKelvey, Mirabeau, & Oztas, 2006; Rivkin & Siggelkow, 2002). In this way, organizations can be seen as taking in information from a host of dimensions, responding to their environments in real time. In concert, organizations comprehend more of their worlds than the sum of individual members, displaying what Weick and Roberts (1993) term "collective mind". Failing to offer widespread access to data systems can hinder what districts can accomplish collectively.

The problem of access is not merely about adopting systems and providing permissions. It is also about promoting access by offering effective systems that give users value. One important aspect is to provide systems that offer robust information, while remaining intuitive and easy to use. Using data systems should feel worthwhile and beneficial, not frustrating or discouraging. This is in line with research on data use. For instance, Kerr et al. (2006) found that challenges such as interface design and system responsiveness influenced the degree to which data use was seen as beneficial. Other researchers note the importance of efficiency, asserting that the easier it is to get data out of the system, the more time can be spent analyzing and interpreting the data (Boudett et al. 2005; Wayman et al., 2004).

While some of these issues may be attended to by designers, districts can also influence how educators come to understand their systems. Perceptions about ease of system use and the usefulness of information can play an important role in the adoption and use of information systems (Venkatesh, Morris, Davis, & Davis, 2003; Wixom & Todd, 2005). Thus, districts can work to help educators become

comfortable with and to see the value in their systems. Further, districts can attend to the tension between what data systems *actually do* with what people think they *ought to be doing*. Leonardi (2009) describes how misalignment between these factors led to people rejecting technologies that might otherwise have supported shared organizational aims. An example in education was offered by Wayman, Cho, and Shaw (2009), who described educator confusion between reports for diagnostic purposes and those for predicting performance on the state test. Educators in this district were only given access to predictive reports and not shown how they could be used. They consequently rejected not only the reports but the whole system, for not being granular or "diagnostic enough", when such was not its intended purpose.

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Collegial relationships

Throughout our article, we have noted the importance of social interactions and connectivity among educators. This has been described in terms of helping educators to coordinate with each other and to share knowledge. It has also been described in terms of helping the organization to be more responsive to its environment and to shape the eventual adoption of data systems. Our final observation is that districts should support collegiality and professional community via the implementation of computer data systems.

Scholars have highlighted the importance of professional relationships and connectivity, via both formal and informal interactions (e.g., Brown & Duguid, 1991; Davenport & Prusak, 1998; DuFour et al., 2005; Fullan, 2007; Lave & Wenger, 1991; Louis, 2007). We see data systems as rapidly advancing toward supporting a multitude of conduits for sharing expertise throughout the organization. Although many systems focus merely on information that is easily codified, there is a trend to move toward systems that additionally leverage experience, intuition, and craft knowledge (Nonaka et al., 1998; Stenmark, 2000; Wayman, Cho, & Richards, 2010). For example, systems may offer activities such as the rating, ranking, or reviewing of information. These systems not only link expertise but also serve as venue for creating norms (Forman, Ghose, & Wiesenfeld, 2008). Systems can also be used to connect or recommend experts to one another (Alavi & Leidner, 2001; Malone, Yates, & Benjamin, 1987; Stenmark, 2000; Swan, 2009). To illustrate, some designers have already begun creating data systems where tailored instructional resources, classroom lessons, and reports might be "pushed" to educators. Although this has yet to be studied or implemented widely, we can imagine the value of data systems take into account the things that particular teachers find practically and quantitatively beneficial for particular students.

Conclusion

In the present study, we provided a set of solutions and considerations in response to three issues that have been shown to be particularly troublesome to educators wishing to improve their use of data. In pursuing these solutions and considerations, we took an organizational view, arguing that districts which view themselves as integrated, aligned learning organizations are best positioned to use data effectively from top to bottom. Accordingly, we drew from literature on organizational learning, educational change, knowledge management, and educational data use to elucidate potential solutions to inform these solutions.

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In closing, we would like to draw attention to two themes which were threaded throughout discussion. First, data use is an inherently social activity. Whether working toward common understandings, professional learning, or better computer data systems, the research is clear that districts can realize better educational improvement if their educators work together. In working together, educators share information, pool expertise, and learn from each other. Connections that can be fostered were evident throughout all three of our focus areas.

Second, building systemic capacity for using data is ultimately about individual capacity. Organizations that create ways for individuals to improve, and in doing so, embrace the creativity and individuality that is intrinsic to all educators, are organizations that are more nimble in identifying problems and mounting effective responses. Such organizations are true learning organizations that never stop improving.

We believe our vision of the Data-Informed District is quite attainable. Many of the problems presented here are complex, but may not be hard to address. This is because the considerations we have forwarded are not specific to this "new world" of data use but are just good education. While there is much left to learn about how our recommended approaches best fit various schooling contexts, we are steadfast in our belief that all educators want to know more about their students, and we believe the systemic response described here can be effective in supporting this basic aim.

Acknowledgements

The authors thank Virginia Snodgrass Rangel, Daniel Spikes, and Brad Davis for their contributions to this manuscript. We also wish to express our gratitude to all of the educators who kindly gave their time and effort to participate in our study.

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