Teacher Needs for Data-Related Professional Learning

Jeffrey C. Wayman, Ph.D.
Wayman Services, LLC

Jo Beth Jimerson, Ph.D.
Texas Christian University

Abstract

Educators are expected to use data to improve teaching and learning. Yet data use is complex: Even after decades of accountability pressures, teachers still struggle with using data to inform instructional practice, often because they receive inadequate data-related professional learning. In this study, qualitative data from 110 participants were used to address two questions: (1) What skills do teachers believe are necessary to use data effectively? (2) How do teachers want to receive data-related professional learning? Teachers articulated a common core of data-related learning needs, and this core aligned well with general research on professional learning. However, professional learning supports rarely matched these needs. Findings are viewed in light of previous research to suggest avenues to improve data-related professional learning.

Introduction

Since the early 1980s, the school accountability movement in the United States has grown from the efforts of a few states to establish minimum testing requirements for graduation to an encompassing nationwide effort to leverage improved academic outcomes through state- and federal- testing requirements (Beadie, 2004; Thomas & Brady, 2005; Wells, 2009). As policy actors attempted to leverage improvement through accountability mechanisms, technological advances improved the speed and ease by which teachers could generate, analyze, and respond to various educational data (Burch & Hayes, 2009; Wayman, 2005; Wayman, Stringfield, & Yakimowski, 2004). Due to technological advances, as well as to public expectations and policy pressures, teachers across the United States are expected to use a variety of data to inform and improve classroom practice (Anderson, Leithwood, & Strauss, 2010; Means, Padilla, DeBarger, & Bakia, 2009; Wayman, Cho, Jimerson, & Spikes 2012).

Still, research indicates that educators struggle with using data to inform practice, citing issues such as data systems, principal leadership, time, and a lack of knowledge about how best to use data to improve instruction (Anderson et al., 2010; Earl & Fullan, 2003; Goertz, Olah, & Riggin, 2010; Means, Padilla, & Gallagher, 2010; Wayman, Cho et al., 2012; Valli & Buese, 2007). Specific to knowledge, this same research base often indicates that a lack of quality data-related professional learning opportunities contribute to this knowledge gap. *Quality* is an operative word here – teachers are often exposed to plenty of professional learning about data use, but often report that little of it meets their practical needs (Means et al., 2010; Wayman, Snodgrass Rangel, Jimerson, & Cho 2010; Wayman, Cho, & Johnston., 2007).

Despite these proven challenges, studies rarely examine data-related professional learning directly. Research on data use sometimes addresses professional learning, but usually as a

smaller piece of a larger study (Anderson et al., 2010; Datnow, Park, & Wohlstetter, 2007; Supovitz & Klein, 2003; Wayman, Jimerson, & Cho, 2012). Further, the professional learning literature is robust when it comes to characteristics of effective professional learning in a broader sense, but supporting teachers in becoming better users of educational data is not a focus of this body of research (e.g., Desimone, Porter, Garet, Yoon, & Birman, 2002; Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009).

Consequently, the goal of the present study was to examine the intersection of professional learning and educational data use. In pursuit of this goal, we focused on two research questions:

(1) What skills do teachers need to use data effectively?

(2) How should teachers receive data-related professional learning?

Research on Data Use and Professional Learning

Before providing some background on pertinent research literature, it is important to define some terms used throughout this paper. First, we consider *data* to be any information that helps educators know more about their students and which can be codified in some manner. Examples include state achievement tests, benchmark assessments, locally-developed periodic assessments, quizzes, disciplinary information, parental information, and teacher observations. Second, we consider *data use* to be the actions in which educators engage as they collect, organize, analyze, and draw meaning from these data in efforts to inform practice. Third, we often use the term *effective data use* to distinguish between data use practices that benefit educators in their practice from other data use practices that have been shown to actually hinder educational work (Earl & Fullan, 2003; Valli & Buese, 2007; Wayman et al., 2010; Young,

2006). Finally, we define *data-related professional learning* to mean the activities in which educators participate to learn various skills for effective data use.

Two streams of research inform our thinking about data-related professional learning: the literature base on educational data use and the literature base on professional learning. In the following two sections, we provide overviews of these two bodies of research.

Research on Data Use

Several studies have identified conditions that facilitate faculty use of data (e.g., Datnow, Park, & Wohlstetter, 2007; Lachat & Smith, 2005; Marsh, McCombs, & Martorell, 2010; Schildkamp & Kuiper, 2010; Wayman, Cho et al., 2012; Wayman & Stringfield, 2006). In this section, we first provide a section that discusses the conditions themselves. Next, we provide two sections that discuss critical supports for these conditions: leadership and computer data systems.

Conditions that facilitate faculty data use. Research suggests a number of skill areas important to teacher data use. Four of the most prominent are collaboration, common understandings, triangulation, and time. We offer a brief section on each.

Collaboration. Collaboration is one of the most important characteristics of effective data use, enabling educators to bring various perspectives to the table of meaning-making. Educators have been shown collaborating around data in a variety of ways, such as grade-level teams, subject-level teams, or professional learning communities (Kerr et al., 2006; Lachat & Smith, 2005; Schildkamp & Kuiper, 2010; Wayman & Stringfield, 2006).

Common understandings. It is also important that educators share some common understandings about the goals and purposes of data use (Park & Datnow, 2009; Supovitz & Klein, 2003; Wayman et al., 2007; Wayman, Jimerson, & Cho, 2012). This research suggests that as educators work together around data, they co-construct a foundation of understandings

related to data (goals, purposes, definitions) that permit them to forge ahead in using data in ways that are increasingly complex. When educators participate in the intentional building of common understandings, they are simultaneously participating in valuable learning experiences (Wayman, Jimerson, & Cho, 2012).

   Triangulation. Much of the data use literature also highlights the importance of "triangulation," or of using multiple data elements in the decision-making process (Copland, Knapp, & Swinnerton, 2009; Louis et al., 2010; Marsh et al., 2010; Wayman & Stringfield, 2006). Building the capacity to effectively use multiple elements will require many dimensions of professional learning. One of the most important will be to maintain coherence; teachers must learn to use multiple measures in a way that responds directly to the work they are doing.

   Time. Finally, research frequently documents effective data use in contexts resourced by sufficient time to perform the above tasks (Ikemoto & Marsh, 2007; Park & Datnow, 2009; Wayman & Stringfield, 2006). Time can be leveraged through existing structures such that data use can be embedded into everyday work (Datnow et al., 2007; Wayman & Stringfield, 2006). Time for professional learning is a scarce resource for many school districts (Schildkamp & Kuiper, 2010; Wei et al., 2010), so embedding learning about data use into the regular context of work provides a way for district leaders to support teachers in data use-related learning while getting the most out of the time allotted (Wayman, Jimerson, & Cho, 2012).

   Leadership. Research is nearly unanimous about the importance of leadership for effective faculty data use (e.g., Datnow et al., 2007; Knapp et al., 2006; Louis, 2007; Louis et al., 2010; Park & Datnow, 2009; Supovitz & Klein, 2003; Talbert et al., 2010; Wayman & Stringfield, 2006). Principal leadership is critical in establishing and supporting school cultures that enable conversations geared toward improving teaching and learning (Anderson et al., 2010;

Louis et al., 2010; Wayman, Spring, Lemke, & Lehr, 2012,). Park and Datnow (2009) stressed the importance of "…creating an ethos of learning and continuous improvement rather than one of blame" (p. 491), as opposed to a culture marked by misuses of data or an overemphasis on accountability and compliance demands (Earl & Fullan, 2003; Valli & Buese, 2007).

In this vein, several studies suggest a core body of strategies that principals may employ to facilitate faculty data use (Anderson et al., 2010; Marsh et al., 2010; Wayman et al., 2012). Examples of such strategies included goal-setting, structuring time for collaboration, and helping faculty to know the right questions to ask of data. Thus, a principal might not only structure time for collaboration, but structure what teachers do in that time to include active and contextual learning. Or, a principal might employ an instructional coach to observe teachers individually during teaching, then debrief during team time about questions they might ask from their data based on the lessons they just taught.

Computer data systems. Computer data systems that deliver data to educators in an efficient, user-friendly fashion are a critical support for educational data use (Lachat & Smith, 2005; Means et al., 2010; Wayman & Stringfield, 2006, Wayman et al., 2004). Unfortunately, they sometimes are underutilized, often due to lack of educator preparation (Means et al., 2009; Wayman, Cho et al., 2012; Wayman et al., 2007; Wayman et al., 2009).

Prior research has shown educators can work well collaboratively around these systems (Lachat & Smith, 2005; Wayman & Stringfield, 2006), even going so far as to suggest that computer systems can be a facilitator of professional learning (Wayman, Jimerson, & Cho, 2012). Importantly, this research does not demonstrate teachers learning to use the *system*, but learning to use *data from the system*. This distinction opens myriad possibilities for embedding

learning in work, coherence, and other tenets of effective professional learning discussed in the next section.

Research on Professional Learning

In his analysis of the professional learning "knowing-doing gap," Thomas Guskey noted:

Rather than trying to identify indisputable best practices, we should acknowledge that schools vary greatly, and that few if any professional development strategies, techniques, or activities work equally well in all. A far more productive approach would identify specific *core elements* of professional development that contribute to effectiveness and then describe how best to adapt these elements to specific contexts. (2009, p. 229)

We considered this a wise admonition and read the professional learning literature with an eye towards such areas. This review of the research suggests that educators benefit from professional learning activities that are: (1) collaborative, (2) engaging, (3) contextual, (4) job-embedded, (5) intense, and (6) coherent. In the following we briefly elaborate on each.

Collaborative. Research suggests that educators learn well collaboratively. Learning structures that support and even require collaboration among educators can lead to positive changes in practice because educators get to exchange ideas and use others' thinking to adapt their own (Desimone et al., 2002; Elmore, 2004; Garet, Porter, Desimone, Birman, & Yoon, 2001). Gallucci (2008) points out that collaborative professional learning not only reinforces new knowledge and skills, but also works through the norming processes and problem-solving practices that can occur in collaborative structures. One group structure that seems particularly useful is to learn in a job-based "collective" (e.g., department , grade-level team). Thus, teachers who work in interdisciplinary, content-area, or grade level teams might benefit from attending learning sessions as a team. In this context, educators do not attend professional development as individuals and then return to work, but work as interdependent team members in both the learning and work contexts (Desimone et al., 2002; Wei et al., 2009; Yates, 2007).

Engaging. Research advocates for professional learning that is cognitively engaging and provides the opportunity to interact with fellow learners (Garet et al., 2001; Saxe, Gearhart, & Nasir, 2001; Wei et al., 2009; Yates, 2007). The literature is clear that educators not only prefer learning that is actively engaging and socially rich, but that such professional learning is associated with greater implementation efforts and with teacher-reported changes in practice (e.g., Desimone et al., 2002; Garet et al., 2001; Saxe et al., 2001; Yates, 2007). While these structures stand in contrast to passive, one-way "sit-and-get" models, Guskey and Yoon (2009) note that engaging learning and traditional forms of professional development are not mutually exclusive: traditional workshops can be planned to include cognitively and socially engaging learning activities.

Contextual. Research suggests that educators respond well to professional learning that is attentive to their context. Professional learning that relates directly to teachers' content areas and job duties helps them forge connections between new knowledge and content (Borko, 2004; Garet et al., 2001; Ingvarson, Meiers, & Beavis, 2005). For example, context-attentive learning for teachers might be tied explicitly to a math or writing lesson in which they are currently engaged. Context-attentiveness also means that the learning experience relates to the educational setting (Borko, 2004; Brown, Collins, & Duguid, 1989; Spillane & Louis, 2002). Much like the sports adage, "you play like you practice," this research suggests that professional learning works best when educators have the opportunity to practice using new knowledge and skills in ways similar to how they will be expected to deploy those skills in their "real" work.

Job-embedded. Job-embedded learning happens in the course of the educator's actual job performance (Borko, 2004; Elmore, 2004; Fullan, 2007; Guskey, 2009) and serves to facilitate context-attentive learning. Job-embedded learning structures allow educators to try out

their new learning immediately and within their daily practice, thus creating a personal feedback loop. This is important, because research suggests that teachers maintain changes in practice when they can see that it results in better outcomes (Fullan, 2007; Guskey, 1989, 2002). Guskey and Yoon (2009) highlight two key elements of job-embedded learning: (1) it occurs within the structure of the regular workday, and (2) it is responsive to the needs of the educator at the moment of need.

Intense. New learning is partly a function of time devoted by the learner. In the research literature, this concept is frequently characterized by *intensity*, a term that encompasses two dimensions of time – *duration* and *span* (Garet et al., 2001; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007). Duration deals with the raw number of hours deals spent in learning, and span is refers to the time period over which the learning activities transpired. Not surprisingly, research has shown that longer duration leads to increased learning (Desimone et al., 2002; Wei et al., 2009; Yoon et al., 2007). But opportunities with sufficient duration must also be of sufficient span. That is, they must sustain a learning focus over a sufficient time span to realize changes in practice improvement (Desimone et al., 2002; Elmore, 2004; Wei et al., 2009).

Coherent. If a school or district has attended to professional learning characteristics discussed thus far, it should be well-positioned to provide coherent learning experiences. For example, the notions of context, job-embeddedness, and intensity are all evidenced in the writing of Garet et al. (2001), who noted that coherence is enhanced by professional learning that is "integrated into the daily life of the school" and is connected to later work and learning through intentional programmatic follow-up (p. 935). Thus, coherence relates to individuals in terms of fitting professional learning experiences to prior knowledge and previous learning (Desimone et al., 2002; Newmann, King, & Youngs 2000; Wei et al., 2009) and relates to organizations in

terms of structuring learning experiences to mesh with job expectations and activities (Borko et al., 2003; Desimone et al., 2002; Yates, 2007).

<div align="center">Methods</div>

Introduction

Data were collected in three districts in Texas. Study districts were chosen from a pool of volunteer districts to provide diversity in terms of size, achievement, and socioeconomic makeup. Study districts were not selected for their success at using data; in fact, district leaders volunteered for this study to improve their districts' data use. In the following section, we describe the contexts within which the study districts operate. Next is a section describing procedures used in collecting and analyzing data for the study.

The Study Districts

Boyer School District was a district of approximately 8,000 students that mostly served a non-Latino White population,[1] less than five percent of who were economically disadvantaged. Educators in Boyer spoke of data use primarily in terms of state test scores. Most students in Boyer easily met minimum state standards, so many educators believed "data use" to be inapplicable to their context. Boyer employed periodic curriculum-driven benchmark exams district-wide but computer systems made these assessment results difficult to access. In a typical year, the percent of students meeting standards on the state exam was consistently greater than 95% in Boyer; the overall state rate was typically about 82%.

Gibson School District was a district of approximately 25,000 students of various ethnic backgrounds,[2] half of whom were economically disadvantaged. State test performance was important in Gibson, but educators spoke of these tests as one of many student achievement

---

[1] 80% non-Latino White, 10% Latino.
[2] 40% Latino, 30% non-Latino White, 20% African American.

indicators. Much of "data use" in Gibson surrounded a set of locally-developed benchmark exams tied to the curriculum. In a typical year, the percent of Gibson students meeting standards on the state exam was approximately 75%.

Musial School District was a district of approximately 45,000 students of various ethnic backgrounds,[3] a third of who were economically disadvantaged. State test performance was a very strong focus throughout Musial. Musial employed district-wide benchmark tests that were intended to align to curriculum and to predict state test outcomes. In a typical year, the percent of Musial students meeting standards on the state exam was approximately 85%.

Procedures

Data were collected through interviews, focus groups, observations, and document analysis. In line with our research questions, we focused on determining which skills participants believed teachers needed in order to be effective users of student data and how participants wanted to receive data-related professional learning. In the following sections we describe our procedure, including data collection, protocols, and analyses.

Data collection. Data were collected through focus groups and interviews of teachers, principals, support personnel and central office administrators. Table 1 provides a description of participants by role and district. In addition, we collected district documents that triangulated our interviews. All interviews and focus groups were recorded and transcribed; transcriptions and collected documents were loaded into Atlas.ti software to facilitate final coding and analysis.

We used a stratified random sampling process to identify one high school, one middle school, and one elementary school within each district. We aimed to include voices throughout a school, including campus administration, classroom teachers, instructional support personnel

---

[3] 50% non-Latino White, 25% Latino, 10% African American.

(e.g., instructional coaches, data coaches, curriculum specialists), and individuals perceived as expert in the use of data to inform classroom practice. To attain such breadth, we conducted individual interviews of campus principals at each site. Data from teachers and other roles were collected through focus groups.

At each school, we conducted two focus groups, each ranging from three to six participants. The first focus group consisted of randomly-selected teachers. The second focus group consisted of "exemplary users" (individuals seen as "go-to" persons for data use) selected through a peer nomination process. We chose this method in an attempt to ensure that we did not unwittingly exclude any data-able educators who could speak to effective professional learning for data use at a campus or in a district.

At the district level, we used a snowball method to identify persons whose job responsibilities entailed planning or supporting professional learning and/or data use. This ensured that we obtained a diversity of perspectives on teacher needs and experiences.

Protocols. Focus groups and interviews were conducted relying on semi-structured protocols that allowed discussion to flow while ensuring that critical elements were addressed. Protocols addressed questions such as, "What should teachers know to be effective users of data?"; "How do you best learn any new skill?"; "How is professional learning delivered in your district?"; and "Describe some data-related professional learning in which you have participated." Questions changed slightly depending on participant role (teachers, principals, or central office administrators), but each protocol addressed the same major concepts.

Analyses. Data analysis proceeded as suggested by Miles & Huberman (1994). A list of starter codes were constructed from our literature review, then these codes were allowed to evolve as we proceeded with analysis. To answer research question one ("What skills do teachers

believe are necessary to use data effectively?"), we created starter codes that reflected the qualities our literature review suggested are critical (e.g., "collaboration," "leadership"). To answer research question two ("How do teachers want to receive data-related professional learning?"), we referenced both professional learning literature and data use literature to begin our list of codes (e.g., "coherent," "contextual").

As we moved through the early stages of data collection and transcription, we used team dialogues and summary memos to flesh out our list of codes for use during final coding and analysis. We engaged in this process for each district individually, followed by a similar process to generate across-case analysis that permitted us to look for common themes across districts.

Findings

In this section, we present findings in two parts, corresponding to the two research questions. The first section outlines findings regarding what teachers need in terms of data-related professional learning. The second section describes findings regarding the ways teachers want to receive data-related professional learning.

What Skills Do Teachers Need to Use Data Effectively?

Educators identified a range of data-related competencies needed for teachers to be competent users of data. Analysis revealed six broad areas of data-related competencies: (1) asking the right questions; (2) integrating data use with curriculum, instruction, and assessment; (3) analyzing and interpreting data; (4) linking data to classroom practice; (5) computer skills; and (6) collaborating around data. These areas were identified in each district and educators varied little across districts in the way they described their needs. We provide a section describing the findings in each area, noting district-based differences where pertinent.

Asking the right questions. A few educators in each district talked about how important it was to pose thoughtful, relevant questions of the data. As a Musial high school teacher noted, "You can have the data and it can mean nothing to you if you don't know how to really start asking the right questions."

Data often felt overwhelming to teachers due to its vastness. One Gibson middle school teacher characterized herself as "drowning in data," while an elementary teacher in Musial teacher noted, "What's hard is sometimes trying to get started. I just sit there and go, 'I don't know where to start. I don't know where to start, because there's so much to do.' And I just sit there and think, 'Wow.'"

As an antidote, several educators in each district suggested that knowing "which questions to ask" can help reduce data use to a manageable task. These educators felt that if teachers learned to identify important areas for inquiry (along with the data best suited for a particular question), they would be better equipped to engage in data use and judge which questions would be worth their time to pursue.

Integrating data use with curriculum, instruction, and assessment. Many educators in each district believed it was important for teachers to learn how to integrate data use into the "whole" of curriculum, instruction, and assessment. That is, educators wanted to learn how to use data within their day-to-day scope and sequence so they could adjust their teaching or lesson plans sooner.

Educators in all three districts said that if they learned how to use data more formatively (i.e., doing more "real-time" assessment), they could better react to student needs. For example, they expressed that using data more formatively might enable them to expand or contract

teaching units during the year, or even make adjustments to the next day's lesson. In expressing

this learning need, a teacher offered a counterexample:

> So when you get your printout, you know exactly which [standards] your child was deficient in. And I think our problem at this point is, "Great. I know where they're weak. What do I do to go back and teach that when I need to be moving on to new content?"

Although the learning needs expressed by educators were similar in all districts, they

arose from different contexts. Gibson and Musial had an explicit structure for interim assessment

within each district's curriculum pacing. Still, several teachers in Gibson noted that "data use"

seemed to be more oriented toward looking at what to change next year, rather than helping

teachers learn to be responsive on an ongoing basis. Teachers in Musial sometimes talked about

a need to collect data using formative assessment processes more efficiently, rather than waiting

for the district to provide common assessments or benchmarks. Boyer did not have mandatory

assessments built into the curriculum, but the district was engaging teachers in writing

assessments collaboratively. Still, many teachers were unsure whether they had the skills to write

valid assessments and capably integrate them into daily practice.

Analyzing and interpreting data. Numerous educators in all three districts said that

teachers needed skills related to analyzing and interpreting data. A Musial middle school teacher

described these skills as generally needing to "know what we're looking at" in a way so that the

data were not "just numbers on a page." When participants spoke of these skills, they spoke in

terms of their practice, indicating they wanted to have enough knowledge to feel comfortable

that they were making appropriate decisions based on their data. Participants not only noted

these skills as important, but also frequently characterized themselves and others as deficient in

these skills.

One frequently mentioned skill involved "triangulation," with several educators in each district noting the importance of using multiple data points to make correct decisions. These educators wanted to learn how to better contextualize *multiple* data points, believing they could draw better conclusions from data and select solutions. Many educators in the Gibson and Musial districts spoke in terms of assessment literacy. These educators wanted to know more about the capabilities of various types of assessments, such as classroom tests, reading inventories, and state test scores. Along these lines, some educators expressed a need to know more about the relative benefits and uses of various forms of measurement, such as raw scores or scale scores.

The need for these skills was not just noted by teachers, but even by some instructional coaches (who often functioned as teachers-to-the-teachers). For instance, one Boyer instructional coach, who was also identified by his colleagues as an "exemplar" user, worried about his expertise thusly:

> Sometimes I feel like I don't really know what it is I'm doing with the data—I feel like there's a lot of data there, and I feel like I don't even know what I'm doing with the data. So I think a lot of time when I have to go into analyzing data and determining what it is I have to do with the data—what does it even mean?

Linking data to classroom decision-making. In every district, when we asked educators what they needed to learn about using data, one of the most common answers was, "what do we *do* with it?!" That is, teachers wanted professional learning that helped them turn the information they got from data into better instructional decisions in the classroom. One Gibson administrator said that district educators had spent a lot of time learning to access data, but answering the question, "what do I do with this information?" was a newer experience. A Musial high school teacher shared, "I spend all this time looking at data and never have time to decide what I'm going to do different."

This skill was often separated from accessing data, performing data analysis, or even from determining a student's instructional need. For instance, several educators in each district noted that they could access data from systems, but felt perplexed at how to connect these data to concrete changes in practice. Further, many teachers said that even when they were able to identify a student's learning need, they still were unsure how to put that conclusion into action. Even a teacher identified as an "exemplar" user by her Gibson colleagues noted this struggle:

> So, I have this, now what? What do I do with it? How do I make it practical? How does it make a difference? What do I do different? That sort of thing. The practical, everyday part is, I think, the thing that's most difficult.

Several teachers in each district specifically said they needed guidance in selecting from various solution options (e.g., special programs, remediation, differentiated grouping) and in evaluating the chosen solution options for effectiveness. Further, some wished there were some sort of master "matching" list that helped them supplement data analysis with action steps.

Computer skills. In each district, many educators noted that teachers should be skilled in operating the various data systems that enabled them to access student data. This included knowing how to input, access, and query data, along with knowing which systems held particular data. This was in line with district expectations that teachers should be independent users of data. As a district administrator in Musial put it, "I think data should be served up like a fountain drink – you know – you can just walk up and get it yourself."

Across the three districts, many educators cast the learning of this skill set as being "tech-savvy," and some speculated that younger teachers might be better at using data systems. These comments notwithstanding, the data suggest that data systems skills are not wholly dependent on pre-existing comfort with technology. Many educators pointed out that the more they used a given system, the more comfortable and familiar they became with it. Further, many educators

identified by their peers as "exemplar users" said that they developed their level of comfort with technology through practice and continued use. In fact, most teachers identified as "exemplar users" by their peers were veterans, as opposed to less-experienced teachers (who might have been assumed to be more "tech-savvy").

Collaborating around data. During conversations with educators, the topic of collaboration arose frequently. Educators frequently talked about things that facilitated or hindered collaboration. For instance, educators described the benefits of collaborating in collegial, non-threatening ways that enabled shared ideas. Educators also spoke of the hindrances to collaboration, such as sometimes feeling "attacked" during conversations or "blamed" for data results. While only a handful of educators in each district explicitly stated that collaborating around data was a skill that needed to be addressed via professional learning, the frequency with which participants talked about valuing collaboration in data use—combined with comments about the difficulties they encountered in collaborating around data—suggested that skills for supporting productive data-related collaboration are important.

How Should Teachers Receive Data-Related Professional Learning?

Besides skills and knowledge, educators also discussed their needs in terms of how professional learning was delivered. Analyses suggested that these needs could be characterized as: (1) contextual; (2) coherent; (3) active; (4) credible; (5) timely; (6) resourced; and (7) followed-up.

The first three themes were directly consistent with prior research as described in our literature review. The final four themes did not appear specifically in our literature review, but previously-identified themes were sometimes threaded through them, such as collaboration or job-embeddedness. Further, preferred characteristics were similarly discussed in all three

districts, with the exception of credible and resourced learning. In what follows, we elaborate on findings as they pertain to these seven themes.

Contextual. Educators in this study frequently described that they wanted contextual learning formats, i.e., formats that enabled learning to occur in ways highly relevant to their current practice. For instance, many teachers in each district were insistent that data-related professional learning needed to be specific to their respective content- and grade level (e.g., "how this fits with third grade math instruction"). Elementary teachers in Musial reported that sometimes they were split into "primary" and "elementary" grades for professional learning, but said that this was not specific enough; they wanted to learn within their specific grade levels and have learning focused on content area. Similarly, secondary teachers in each district were quick to point out that subject-specific professional learning was important.

Across districts, educators did not speak favorably of professional learning where they were expected to generalize to their particular roles. Instead, they wanted to be using actual data on students in their classrooms. In particular, several Gibson teachers complained that data-related trainings were often "one size fits all" events that covered a general set of common skills that educators were to apply to their specific contexts. They reported this format was ineffective and that they were not motivated to use data as a consequence.

Coherent. Numerous educators spoke of wanting professional learning that fit well with prior learning (i.e., learning that was "coherent"). Participant comments echoed this desire for coherence in several ways. For example, educators wanted data-related professional learning to build upon prior skills, similar to how they tried to scaffold instruction for their own students. Similarly, educators wanted professional learning to be aligned from year to year. Several Boyer educators asserted that professional development changed from year to year depending on what

the current theme of the year happened to be (e.g., "creativity" or "assessment"), while a few

Gibson educators characterized their experiences with professional learning as "scattered."

Also, educators viewed professional learning in a larger picture: in each district, they wanted to

know why they were learning certain skills and how these skills fit their job roles. Teachers

wanted to understand how new learning fit with classroom practice and with their broader

purposes as teachers.

Engaging. Numerous comments across all three districts fit the theme of engaging

learning – learning that was socially active and cognitively challenging. Educator descriptions

took many forms. Several educators in each district expressed that they attributed little value to

large-scale, "sit and get" offerings that used lectures to deliver knowledge. One Boyer educator

termed this format "death by PowerPoint." Educators reported boredom and an inability to ask

questions during these sessions.

In contrast, educators wanted professional learning to be delivered in smaller groups

where they could better engage with the material, the presenter, and each other. Educators

(particularly in Gibson and Musial) spoke of the benefits of learning in collectives, such as grade

level or subject level teams. They noted that attending in collectives would enable them to

engage in their specific practice during sessions. A Boyer educator summed this up, saying,

> I want to be able to bounce that idea off my colleague who is also a math teacher, or also
> a language arts teacher. And we need to be able to talk while we're doing that because it
> may not fit me the same as it fits [others].

Educators in Gibson and Musial frequently noted the need to receive data-related

professional learning while accessing their data systems, often using the term "hands on." Data

systems were seen as facilitators of various active learning concepts. One Musial educator had

expressed disappointment in data-related professional learning supports, so she was asked to

describe what she considered an effective format. She responded:

> Go be in a computer lab with everybody that's in your department, pulling up relevant data for you, having the opportunity to pull up your data, then going through it, drawing some conclusions, maybe getting with other people who teach the exact same thing. Like, Algebra I or Geography or whatever. Comparing your data then and drawing some conclusions and seeing how you can chart a path forward. That would be useful.

Credible. In one instance where responses did differ by district, the concept of "credible"

professional learning emerged only in the Gibson and Musial School Districts. These educators

wanted presenters to have enough experience that they could answer, and even anticipate,

questions during the learning sessions. As on Musial teacher put it, "…[credible facilitators] use

it day in and day out and can answer those questions that you're going to come upon every day."

Several expressed a desire that the person presenting or leading the session have recent

experience or currently be a practicing classroom teacher. Some Gibson teachers suggested

specific examples, such as pairing a practicing teacher with a facilitator, or having facilitators

include "success stories" from specific contexts. Some Musial educators wanted presenters to

offer some research background on a tool or strategy. They did not want a formal report, but

were interested in evidence as to why this new knowledge would help their practice.

Timely. In each district, educators said they wanted their professional learning to be

timely. A component of job-embedded professional learning, their comments indicated that

timely professional learning is learning that educators can put to immediate use. One exemplar

user from Musial (who also served a support role) said teachers want to know, "How is this

going to affect me right now, today? How can I use this right now? ... If we don't show them

that, they're not going to use it. So, we try to do things that they'll want to use immediately, and

not sometime down the line." Teachers in each district put a fine point on timeliness, noting that

learning not only needed to be proximal to their work, but needed to come at a time when they

needed to use the data.

Examples again were given in terms of data system training. Several teachers in Musial

and Gibson described training that was provided in the summer, weeks or months before they

actually needed to use data from these systems. In Gibson, many teachers reported that they had

been required to attend training on a new system, but useful data were not fully loaded into the

system until months after the school year began. By the time the data system was usable,

teachers had forgotten many elements of the training.

In contrast, one Gibson teacher talked about a particular data system, saying, "…working

on interventions, I could go pull a kid and it had the history of the kid immediately." In this

case, there was an immediate application for her new knowledge, so the learning made more

sense and could be applied before refresher sessions were needed.

Resourced. In Musial and Gibson ISD, many educators said they wanted data-related

professional learning to be adequately resourced in two main areas: time and materials. In terms

of time, educators said they wanted time built in to professional learning sessions to engage in

guided practice, and to get feedback and ask questions. Participants in both districts reported that

their learning opportunities were almost always limited to the length of time required for

presenters to deliver the new information. Instead, participants wanted structures that

additionally allowed time within the session to process new information and to reflect on how

the new skill(s) might be integrated into practice.

In terms of materials, educators wanted some brief written resources to which they could

refer when they hit roadblocks. They wanted "cheat sheets," manuals, and step-by-step directions

for accessing and using data. Educators in Musial noted that they already had some useful forms,

spreadsheets, or other types of protocols to help guide how they used data, but they expressed a desire for materials like this to support a broader range of skills. Similarly, some Gibson teachers wished for materials that outlined which data were most relevant or pertinent for teachers in their respective contexts (e.g., math, science, elementary reading). It should be noted that a handful of Boyer participants also mentioned "cheat sheets," specific to finding data in their systems.

Followed-up. Educators in all districts expressed a desire for ongoing communication regarding professional learning experiences. After participating in various learning sessions, educators reported that they were rarely checked on by facilitators or leadership to see how they were applying this knowledge. Educators wanted opportunities to apply new learning and then debrief with colleagues or leaders. Participants indicated that more follow-up might also help inform future professional learning offerings. One teacher in Gibson cited the benefits that might be realized if leaders of professional learning visited with teachers, asking questions like, "Did it work for you? What do you need to know now? Where can we go? What can we do for you?"

Follow-up was sometimes a frustration for district leaders, who recognized its value. One Gibson administrator admitted:

> We know the best model for professional development is, "OK, we're going to give you a little bit here and then you're going to go back and implement it and we're going to come back and talk about it and you're going to get your own data and then we're going to come back and look at it." [But] that just does not happen.

Discussion

The goal of our study was to examine the intersection of professional learning and educational data use. Through two research questions, we learned what participants believed teachers needed to be effective data users. We also learned how teachers best received learning about these skills. Although district contexts varied, findings varied little from district to district.

The best way that we can summarize the findings is that teachers need *immediately useful* data-related professional learning. That is, they needed it to be focused on data skills that they could apply in their practice with a minimum of delay. They needed to learn together and engage in conversations about their learning. They needed the content to be aligned so they could build on previous learning. They needed to know that the people they were learning from knew the material and understood the problems that teachers face. They needed their learning to fit their purpose as an educator and the district's mission for educating students.

Unfortunately, participants said their data-related professional learning did not rise to these standards. Their learning opportunities were rarely tailored to their content- or grade-level needs and learning often was provided weeks or months before they could put it into practice. They received instruction in large group settings that were not conducive to conversation and idea exchange. The content of their learning was not aligned from event to event, frequently dealt with topics chosen months in advance, and thus was not appropriately matched to their work. The content they received often focused on technological skills and infrequently on the problem of changing their practice based on new knowledge. Informal learning opportunities did seem to provide a modicum of support for teachers in learning about data use, but these occurred only sporadically. We noted that participants were often complimentary of individuals who helped them learn, both at the district and school level, but these individuals were too few to serve teachers district-wide in consistent and coherent ways.

In summarizing these findings, there are two things that proved contradictory: (1) participants often described data-related skills and methods of receiving them in ways similar to that suggested by prior research, and (2) it was striking how often they described lacking these skills and how often data-related professional learning was delivered in ways counter to their

desires and prior research. In the following narrative, we address both of these issues. First, we

offer a section that views our results through the intersection of the research bases on

professional learning and on data use. Second, we provide a section that uses this information to

construct suggestions on how to empower and improve data-related professional learning.

Viewing Findings in Light of Prior Research

Research on effective data use has yet to empirically examine the intersection of

professional learning research and data use research. Thus, in the following narrative, we use the

research bases on professional learning and data use concomitantly to better understand our

findings. We found that many findings aligned well with prior research. Others provided nuance

that may extend previous research, while others suggested possible new directions. In the

following three paragraphs, we offer examples.

Participants often described data-related skills and methods of receiving them in ways

similar to that suggested by prior research. For instance, participants said teachers needed to

know how to ask appropriate questions of the data, how to analyze and interpret their data, how

to link data to practice, and how to efficiently navigate computer data systems. As shown in our

literature review, these skills are well-established as essential to effective data use (e.g., Datnow

et al., 2007; Hamilton et al., 2009; Kerr et al., 2006; Wayman & Stringfield, 2006). Similarly, the

ways educators said teachers should learn these skills often aligned with prior research. For

instance, participants said they needed to learn how to use data in ways that were engaging,

contextual, and coherent (e.g., Desimone et al., 2002; Garet et al., 2001; Wei et al., 2009).

Some findings agreed with prior research, but also presented nuance not previously

revealed in these research bases. For example, in line with research on data use, educators spoke

of learning time as a resource and highlighted the need for timely learning (e.g., Datnow et al.,

2007; Wayman, Jimerson, & Cho, 2012; Wayman & Stringfield, 2006). However, they never extended their discussion to time-intensity in terms of duration and span, as does the professional learning literature (Desimone et al., 2002; Garet et al., 2001; Wayman, Jimerson, & Cho, 2012; Wei et al., 2009). Consequently, it may be important to help educators learn to consider how issues of duration and span may increase their learning about data use. Also, educators in the present study cited the importance of collaboration (e.g., Hamilton et al., 2009; Supovitz & Klein, 2003; Wei et al., 2009), but never suggested they needed to learn skills to ensure collaboration was effective. Prior research treats collaboration similarly – as an important activity, but not one about which to teach specific skills. Thus, it may be important to include collaboration-related skills in data-related professional learning offerings.

Other aspects of our results did not align with prior research and may indicate directions for future study. First, participants wanted to better integrate data use skills with curriculum planning and pacing, a skill not often noted in either data use or professional learning literature. Second, participants outlined the importance of receiving their learning from credible sources and of having adequate materials to help them when they are using data independently. We did not find these issues frequently addressed in either of the literature bases. Third, educators offered few mentions of skills for establishing common understandings about the purposes of and rationale for data use. It may be important to understand why educators are not considering this issue, since this skill is increasingly being discussed as important to effective data use (Datnow et al., 2007; Supovitz & Klein, 2003; Wayman et al., 2007; Wayman, Jimerson, & Cho, 2012).

Supporting and Empowering Data-Related Professional Learning

As we considered ways to improve data-related professional learning in practice, we noted that learning is reciprocal and mutually reinforcing: The organization (school or district) supports the learning of individuals and collectives, but structures must also be in place to enable these individuals and collectives to share knowledge back into and through the organization (Wayman, Cho, et al., 2012; Wayman, Jimerson, & Cho, 2012). To facilitate this kind of learning in support of improved data use, we propose four directions that districts may explore to better support data-related professional learning: (1) expand the cycle of inquiry to include data-related professional learning; (2) align data-related professional learning with individual and organizational goals; (3) treat data-related professional learning as an integral component of all learning activities; and (4) make collaboration an essential element of data-related professional learning.

Expand the cycle of inquiry to include data-related professional learning. The results of the present study indicate that data-related professional learning was disjoint. Thus, we recommend that data-related professional learning be purposefully included within each stage of a cycle of data-informed inquiry. Many scholars have described cycles, sharing similar functions of examining data, drawing meaning from data, and acting on this information (e.g., Bernhardt, 2009; Boudett, City, & Murnane, 2005; Copland, 2003; Mandinach, Honey, Light, & Brunner, 2008). However, most discussions of an inquiry cycle deal with the actual function of data use, not with simultaneously incorporating learning opportunities. Incorporating data-related professional learning into such a cycle is an important change that could help schools.

Data-related professional learning in the study districts was not embedded within a cycle of data use, so our findings offer a counterexample. Across all three districts, participants often

engaged in examining data and drawing meaning from them. However, without support structures and intentional learning opportunities, knowledge from these efforts was rarely preserved.

Align data-related professional learning with individual and district goals. Teachers expressed a desire for data-related professional learning that was coherent, thus enabling them to build skills and knowledge in cumulative fashion. These educators would have benefited from data-related professional learning experiences that fit with their existing knowledge base, with previous learning experiences, *and* with planned future learning experiences (Borko et al., 2003; Desimone et al., 2002; Wei et al., 2009; Yates, 2007). Thus, we recommend that school leaders create professional learning plans that "meet them where they are." In other words, school leaders should create written, aligned plans that clearly articulate accounting for the learner's current knowledge, prior learning experiences, and expected future learning experiences.

Again, our findings offer a counterexample. None of the study districts had structures to ensure such alignment. For example, only Musial had personnel solely dedicated to professional learning. But even in Musial, there was no articulated plan to sequence—or even specifically address elements of—data-related professional learning. Thus, even the stand-alone learning opportunities that were cited as effective were incomplete for meeting data-related learning needs in terms of providing ongoing coherence and usefulness.

Make collaboration an essential element of data-related professional learning. Much of data-related professional learning in the study districts was gained through some form of collaboration. This took on many forms, ranging from large, expert-run convocations to small groups meeting with instructional coaches.

Unfortunately, similar to studies in other contexts (Anderson et al., 2010; Wayman et al., 2009), we saw few structures that ensured consistent collaboration. Consequently, while participants described enjoyment from learning in groups, they rarely realized the enduring benefits that research suggests result from collaboration, such as establishing common understandings or sharing knowledge throughout a school. Thus, we go beyond merely recommending that data-related professional learning be conducted collaboratively. Instead, we recommend that leaders must also establish a number of specific structures to ensure that knowledge is shared and preserved through a variety of collaborative learning opportunities.

Treat data-related professional learning as a component of all learning activities. Findings from the present study suggest that data-related professional learning cannot be reduced to episodic events. We paraphrase Earl and Katz (2009): If data-related professional learning is an event, you don't have a culture. As participants reminded us again and again, receiving their learning in episodic, largely disjointed "events" resulted in a disconnect from their practice that hindered their ability to use data in ways to improve classroom practice.

The informal social structures described by teachers provided some elements of coherence while enabling ongoing skill and knowledge construction. Further, it is not hard to imagine that learning might have proceeded in a cycle similar to that described above, if there were structures that embedded learning throughout everyday work.

Conclusion

When our findings are placed alongside existing research, it seems clear that teachers need a particular skill set in order to use data to inform their practice. Further, it is also clear that their wishes for gaining these skills coincide with the research base on professional learning. Surprisingly little research attention has been focused on the processes and structures that help

teachers gain data skills, which may explain the current state of data-related professional

learning.

The recommendations offered in the present study imply that many solutions are systemic

in nature. In line with the approach of scholars in this area (e.g., Datnow et al., 2007; Supovitz,

2010; Wayman, Jimerson, & Cho, 2012), school leaders may find that improving data-related

professional learning involves making changes to organizational practices are the best way to

build capacity in individual teachers. We hope the results of this study are among the first steps

in a line of scholarly research that improves data-related professional learning for teachers.

References

Anderson, S., Leithwood, K., & Strauss, T. (2010). Leading data use in schools: Organizational conditions and practices at the school and district levels. *Leadership and Policy in Schools, 9*(3), 292-327, DOI: 10.1080/15700761003731492/

Argyris, C., & Schön, D.A. (1996). *Organizational learning II: Theory, Method, and Practice.* New York: Addison-Wesley.

Beadie, N. (2004). Moral errors and strategic mistakes: Lessons from the history of student accountability. In K. A. Sirotnik (Ed.), *Holding accountability accountable: What ought to matter in public education* (pp. 35-50). New York: Teachers College.

Bernhardt, V.L. (2009). *Data, data everywhere: Bringing all the data together for continuous school improvement*. Larchmont, NY: Eye on Education.

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher 33*(8), 3-15.

Boudett, K. P., City, E. A., & Murnane, R.J. (Eds.). (2005). *Data Wise: A step-by-step guide to using assessment results to improve teaching and learning.* Cambridge, MA: Harvard Education Press.

Brown, J.S., Collins, A. & Duguid, P. (1989). Situated cognition and the culture of learning, *Educational Researcher 18*(1), 32–42.

Bryk, A., & Schneider, B. (2002). *Trust in schools: A core resource for improvement*. New York: Russell Sage Foundation.

Burch, P., & Hayes, T. (2009). The role of private firms in data-based decision-making. In Kowalski, T. J., & Lasley, T. J. (Eds.), *Handbook on data-based decision-making in education* (pp. 54-71). New York: Routledge.

Copland, M., Knapp, M. & Swinnerton, J. (2009). Data informed leadership and school improvement. In T. J. Kowalski & T. J. Lasley, T. J. (Eds.). *Handbook on data-based decision making in education*. New York: Routledge.

Datnow, A., Park, V., & Wohlstetter, P. (2007). *Achieving with data: How high-performing school systems use data to improve instruction for elementary students.* Los Angeles: University of Southern California, Rossier School of Education, Center on Educational Governance.

Desimone, L.M., Porter, A.C., Garet, M.S., Yoon, K.S., & Birman, B.F. (2002). Effects of professional development on teachers' instruction: Results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis 24*(2), 81-112.

Earl, L. & Fullan, M. (2003). Using data in leadership for learning. *Cambridge Journal of Education, 33*(3), 383-394.

Elmore, R.F. (2004). *School reform from the inside out: Policy, practice, and performance.* Cambridge, MA: Harvard University Press.

Fullan, M. (2007). *The New Meaning of Educational Change* (4th ed.). New York: Teachers College Press.

Gallucci, C. (2008). Districtwide instructional reform: Using sociocultural theory to link professional learning to organizational support. *American Journal of Education 114*, 541-581.

Garet, M.S., Porter, A.C., Desimone, L., Birman, B.F., & Yoon, K.S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal 38*(4), 915-945.

Goertz, M. E., Olah, L. N., Riggan, M. (2010) *From testing to teaching: The use of interim assessments in classroom instruction.* Philadelphia PA: The Consortium for Policy Research in Education.

Guskey, T.R. (1989). Attitude and perceptual change in teachers. *International Journal of Educational Research, 13,* 439-453.

Guskey, T.R. (2002). Professional development and teacher change. *Teachers and Teaching: theory and practice 8*(3/4), 381-391.

Guskey, T.R. (2009). Closing the knowledge gap on effective professional development. *Educational Horizons* (Annual), 224-233.

Guskey, T. R., & Yoon, K. S. (2009). What works in professional development? *Phi Delta Kappan*, *90*(7), 495-500.

Hamilton, L., Halverson, R., Jackson, S. S., Mandinach, E., Supovitz, J. A., Wayman, J. C. (2009). *Using student achievement data to support instructional decision making*. Washington D.C.: Institute of Education Sciences and the National Center for Education Evaluation.

Ikemoto, G.S. & Marsh, J.A. (2007). Cutting through the "data-driven" mantra: Different conceptions of data-driven decision making. In P.A. Moss (Ed.), *Evidence and decision making* (pp. 74-104). Malden, MA: Blackwell.

Ingvarson, L., Meiers, M., and Beavis, A. (2005). Factors affecting the impact of professional development programs on teachers' knowledge, practice, student outcomes & efficacy. *Education Policy Analysis Archives 13*(10), 1-28.

Kerr, K.I., Marsh, J.A., Ikemoto, G.S., Darilek, H., & Barney, H. (2006). Strategies to promote data use for instructional improvement: Actions, outcomes, and lessons from three urban districts. *American Journal of Education 112*(August), 496-520.

Lachat, M.A. & Smith, S. (2005). Practices that support data use in urban high schools. *Journal of Education for Students Placed At Risk 10*(3), 333-349.

Louis, K.S. (2007). Trust and improvement in schools. *Journal of Educational Change 8,* 1-24.

Louis, K.S., Leithwood, K., Wahlstrom, K., Anderson, S., Michlin, M. Mascall, B., Gordon, M., Strauss, T., Thomas, E., & Moore, S. (2010). *Learning from Leadership: Investigating the links to improved student learning*. Final Report to the Wallace Foundation. New York, NW: The Wallace Foundation.

Mandinach, E., Honey, M., Light, D., & Brunner, C. (2008). A conceptual framework for data-driven decision-making. In E.B. Mandinach & M. Honey (Eds.), *Data-driven school improvement: Linking data and learning* (pp. 13-31). New York: Teachers College Press.

Marsh, J.A., McCombs, J.S., & Martorell, F. (2010). How instructional coaches support data-driven decision making: Policy implementation and effects in Florida middle schools. *Educational Policy 24*(6), 872-907.

Means, B., Padilla, C., DeBarger, A., & Bakia, M. (2009). *Implementing data-informed decision-making in schools—Teacher access, supports and use.* Washington, D.C.: U.S. Department of Education Office of Planning, Evaluation and Policy Development. Accessed 1/29/12 at www.ed.gov/about/offices/list/opepd/ppss/reports.html.

Means, B., Padilla, C. & Gallagher, L. (2010). *Use of education data at the local level: From accountability to instructional* improvement. Washington, D.C.: U.S. Department of Education Office of Planning, Evaluation, and Policy Development. Accessed 1/29/12 at www.ed.gov/about/offices/list/opepd/ppss/reports.html.

Newmann, F.M., King, M.B., & Youngs, P. (2000). Professional development that addresses school capacity: Lessons from urban elementary schools. American Journal of Education 108(4), 259-299.

Park, V. & Datnow, A. (2009). Co-constructing distributed leadership: District and school connections in data-driven decision-making. *School Leadership and Management 29*(5), 477-494.

Penuel, W.R., Fishman, B.J., Yamaguchi, R., & Gallagher, L.P. (2007). What makes professional development effective? Strategies that foster curriculum implementation. *American Educational Research Journal 44*(4), 921-958.

Saxe, G.B., Gearhart, M., & Nasir, N.S. (2001). Enhancing students' understanding of mathematics: A study of three contrasting approaches to professional support. *Journal of Mathematics Teacher Education 4,* 55-79.

Schildkamp, K., & Kuiper, W. (2010). Data-informed curriculum reform: Which data, what purposes, and promoting and hindering factors. *Teaching and teacher education*, 26, 482–496

Senge, P.M. (2006). *The fifth discipline: The art & practice of the learning organization*. New York: Currency Doubleday.

Spillane, J.P. & Louis, K.S. (2002), School Improvement Processes and Practices: Professional Learning for Building Instructional Capacity. Yearbook of the National Society for the Study of Education, 101: 83–104. doi: 10.1111/j.1744-7984.2002.tb00005.x

Supovitz, J. (2010). Knowledge-based organizational learning for instructional improvement. In Hargreaves, A., Lieberman, A., Fullan, M., & Hopkins, D. (Eds.). *Second international handbook of educational change* (pp. 707-723). New York: Springer.

Supovitz, J.A. & Klein, V. (2003). *Mapping a course for improved student learning: How innovative schools systematically use student performance data to guide improvement*. Philadelphia: Consortium for Policy Research in Education-University of Pennsylvania.

Talbert, J.E., Milvea, L., Chen, P. Cor, M., & McLaughlin, M. (2010, November). *Developing school capacity for inquiry-based improvement: Progress, challenges, and resources.* Stanford University Center for Research on the Context of Teaching.

Thomas, J.Y. & Brady, K.P. (2005). The Elementary and Secondary Education Act at 40: Equity, accountability, and the evolving federal role in public education. *Review of Research in Education 29*(1) 51-67.

Valli, L. & Buese, D. (2007). The changing roles of teachers in an era of high-stakes accountability. *American Educational Research Journal 44*(3) 519-558.

Wayman, J.C. (2005). Involving teachers in data-driven decision making: Using computer data systems to support teacher inquiry and reflection. *Journal of Education for Students Placed At Risk 10*(3), 295-308.

Wayman, J.C., & Cho, V. (2009). Preparing educators to effectively use student data systems. In Kowalski, T. J., & Lasley, T. J. (Eds.), *Handbook on data-based decision-making in education* (pp. 89-104). New York: Routledge.

Wayman, J.C., Cho, V., Jimerson, J.B., & Snodgrass Rangel, V.W. (2010, May). *The data-informed district: A systemic approach to educational data use*. Paper presented at the 2010 Annual Meeting of the American Educational Research Association, Denver, CO.

Wayman, J.C., Cho, V., & Johnston, M.T. (2007). *The data-informed district: A district-wide evaluation of data use in the Natrona County School District.* Austin: The University of Texas.

Wayman, J.C., Cho, V. & Shaw, S. (2009). *First year results from an efficacy study of the Acuity data syste.* Austin: Authors. Retrieved 1/29/12 from http://edadmin.edb.utexas.edu/datause/publications.htm.

Wayman, J.C., Jimerson, J.B., & Cho, V. (2012). Organizational considerations in establishing the data-informed district. *School Effectiveness and School Improvement.*

Wayman, J.C., Lehr, M.D., Spring, S.D., & Lemke, M.A. (2011, November*). Principal leadership for effective data use.* Paper presented at the 2011 Annual Convention of the University Council for Educational Administration, Pittsburgh, PA.

Wayman, J.C. & Stringfield, S. (2006). Technology-supported involvement of entire faculties in examination of student data for instructional improvement. *American Journal of Education, 112*(August), 549-571.

Wayman, J.C., Stringfield, S., & Yakimowski, M. (2004) *Software enabling school improvement through the analysis of student data.* Baltimore, MD: Johns Hopkins University Center for Research on the Education of Students Placed At Risk.

Wei, R.C., Darling-Hammond, L., Andree, A., Richardson, N., & Orphanos, S. (2009). *Professional learning in the learning profession: A status report on teacher development in the United States and abroad.* Dallas, TX: National Staff Development Council.

Wells, A.S. (2009). "Our children's burden": A history of federal education policies that ask (now require) our public schools to solve societal inequality. In M.A. Rebell and J.R. Wolff (Eds.) NCLB *at the crossroads: Reexamining the federal effort to close the achievement gap* (pp. 1-42)*.* New York: Teachers College Press.

Yoon, K. S., Duncan, T., Lee, S. W.-Y., Scarloss, B., & Shapley, K. (2007). *Reviewing the evidence on how teacher professional development affects student achievement* (Issues &

Answers Report, REL 2007–No. 033). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest.

Yates, S.M. (2007). Teachers' perceptions of their professional learning activities. *International Education Journal 8*(2), 213-221.

Young, V.M. (2006) Teachers' use of data: Loose coupling, agenda setting, and team norms. *American Journal of Education 112*(August), 521-548.

Tables & Figures

Table 1: Study Participants by Role and District

Participant Role	Boyer ISD	Gibson ISD	Musial ISD
Central Office	6	11	12
Campus Principals	3	3	3
Teachers	16*	17	14
Campus-based support personnel (Assistant Principals, Instructional Coaches, Interventionists)	12	6	7
TOTAL (by campus)	*n=37*	*n=37*	*n=36*
Study Total			*n=110*

*In Boyer, some personnel taught half time and served as instructional coaches half time. For reporting purposes these individuals were counted among the teacher participants.