

EFFECTIVE USE OF ELECTRONIC DATA SYSTEMS:

A Readiness Guide for School and District Leaders



Effective Use of Electronic Data Systems: A Readiness Guide for School and District Leaders

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Prepared by Learning Point Associates

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Using This Guide

Section 1: Tools for School and District Leaders is aimed at school and district leaders who are just beginning to think hard about acquiring an electronic data system. Designed to support each person's thinking, this section contains discussion elements along with corresponding questions that prompt dialogue around key issues for readiness.

Section 2: Tools for Facilitators makes it possible to use the guide as a resource for a group process to ascertain readiness—a sort of needs assessment. This section provides additional information on choosing and implementing a data system that will help guide further investigations, as well as worksheets to help facilitate or organize a discussion.

Section 3: Resources presents a variety of resources for data use and data systems.

Section 1: Tools for School and District Leaders



Setting the Context for Change

Data fuel the process of change. Schools and districts should have electronic data systems that store data and make it easy to extract useful information. You and your staff have questions; you need answers. Your data, when stored in a suitable electronic data system, will help you construct better answers to your questions more quickly. Do you know what your questions are, what they will be? That is, do you *really* know why you want a data system?

Electronic data systems are complex and expensive. They consist of numerous components, pieces, and functions: data warehouses, data marts, data dictionaries, extraction-translation-loading (ETL) tools, data cleansing, analytics, user portals, decision support, identity management, and more. Rather than starting with these specialist's terms, this document begins with your questions:

- What do you want the system to do for you?
- Are you and your organization ready to support a system that does what you want?
- Will you be able to act on what it tells you?
- What is required to get you and your district to that point?

As the late statistician John W. Tukey, Ph.D., (1962) put it, “**Far better an approximate answer to the *right* question ... than an exact answer to the wrong question**” (pp. 13–14).

Decision makers want answers. Answers and decisions both begin with questions. A data system that saves and stores your data—and has easy-to-use tools to render that information promptly and meaningfully—greatly increases the likelihood of better answers more often.

This guide will help you think about what you want from an electronic data system. It will help you identify the right questions to ask about a data system and about your district's readiness and capacity to use it effectively. As you evaluate your responses, you will better understand what you already know and what you have yet to learn, as well as the context within which you will put that knowledge to work. After all, you will not receive good value on investments in these systems if you and your staff are not clear about what you expect, what you want, and what your questions are.

It may be wise to accept Dr. Tukey's (1986) counsel one more time:

“The combination of some data and an aching desire for an answer does not ensure that a reasonable answer can be extracted” (pp. 74–75).

A data system and good questions will help; however, they are no guarantee. You, not the data, will make the decision.

Section 1: Tools for School and District Leaders is organized around eight discussion elements—Will, Scope, Risk, Readiness, Information Quality, System Quality, Impact, and Cost. **Section 2: Tools for Facilitators** is a set of facilitation materials consisting of personal reflection worksheets, a discussion worksheet, and a planning worksheet. **Section 3: Resources** is a brief annotated bibliography of resources for data use and data systems.

Data systems are “back-office” tools in most organizations and businesses. Space up front is given over to showing what the business or organization is about. The same is true in schools and districts: The data system should *support* what

you are trying to accomplish; it should not be *what* you accomplish (unless, of course, your title is chief information officer or data systems manager).

Data make change visible. Science begins with doubt; its hallmark is suspicion (Powers, 1999). Scientists look at evidence, draw inferences, modify what they do, look at the evidence again (Platt, 1964). They continue these repetitions, these trials and errors, these experiments, looking for improvements and are guided by them. Careful data records support accurate inference from observation and second warrants for interpretation. In education, we speak of a culture of inquiry, of continuous improvement cycles, not of experiments. However, the cycle of observation, interpretation, and controlled trials is very much the same. A data system contributes by helping us to store, track, and display relevant data. That's all it does, but that's quite a lot.

The following pages in this section contain information on the following key elements:

- Will
- Scope
- Risk
- Readiness
- Information Quality
- System Quality
- Impact
- Cost

For each element, there is an introduction, questions, and suggestions for interpretation of responses.

Element A: Will

Introduction

A review of data should lead to action. If you are not prepared to do something different, then all the data in the world will not matter.

According to Mel P. Heller, Ed.D., Professor Emeritus of Educational Leadership and Policy Studies at Loyola University of Chicago, “It is permissible to move ahead without the answer; however, if you do not have a question, do not begin.” Heller also reminds us that “waiting for the perfect solution is paralysis.”

Questions are more important than answers. You do not need all the answers to start; in fact, waiting for all the answers means you will not start. Decide where you want to go. Begin going there. Ensuring that you have the necessary will to get there is critical.

Implement small, but have a larger plan. If you begin to invest and build a data system driven by where you are without thinking of where you want to be, you will likely find in the not-so-distant future that you need to start over, again.

The purpose of an electronic data system is to help you navigate changes to monitor improvement efforts. But that contribution is only a part of a larger drive toward continuous improvement. Adopt and work a continuous-improvement cycle. It matters less which cycle than that all staff subscribe to it. Acquiring a data warehouse or a data analysis tool, including investing in staff training in data-driven decision making, is really about efficiency, feedback, and taking action. By placing the data in front of more staff, you also move responsibility for action—and the rationale for taking action—down to the implementer, the doer. You, as leader, can therefore spend your time on determining how to support the good decisions and good work.

Questions Related to Element A: Will

- A1. What will you do if your data tell you that some students are learning but others are not?
- Nothing
 - Something
 - Do not know
- A2. Will you be willing to replace or modify instructional programs or strategies currently in place?
- No
 - Yes
 - Do not know
- A3. Will you let staff members make their own decisions about instruction?
- No
 - Yes
 - Do not know
- A4. Will this data-system effort become a permanent way of doing business?
- No
 - Yes
 - Do not know
- A5. Will the data system be part of a quantitative continuous-improvement process to help you monitor progress to support better decisions?
- No
 - Yes
 - Do not know

Interpretation of Responses

A “Nothing” answer to the first question and more than two “No” answers suggest you do not yet have the will to act upon what the data may tell you. An investment in an electronic data system will probably not help you improve the instructional effectiveness of your school or district.

A “Something” answer to the first question and at least two “Yes” answers confirm that you have the will. As always, the results will be in the details. Please turn the page to continue your efforts.

Any other pattern of responses suggests you should think more about why you need a data system. You’re probably going to benefit from having one, but in order for it to make a strong difference, you first may need to increase your own commitment.

Element B: Scope

Introduction

Order matters: the chicken, the egg; the cart, the horse. Whether the chicken or the egg came first is moot. Chickens didn't evolve from eggs or eggs from chickens—the two came together; the question has little practical application. In the real world, however, placing the horse before the cart works best. In real life, an answer without a question is not particularly useful. A goal without some questioning is dangerous. We can be in a hurry to collect and present data in hope of finding an answer, but if we never state a question, any answer will do.

Begin with a goal, with questions such as “What will learners be able to do when they leave this school?” The term *learner* helps focus on what schools are about. If you ask the average person how to define or recognize a school, the typical response is “where there are students and teachers.” However, it isn't students and teachers that define a school; it's learning.

What should students be learning? How? Why? Today, an easy answer is that the learner will be proficient on the state test. This is where the pain is, especially for schools not meeting adequate yearly progress (AYP). But it is hardly clear how being proficient on a test equips the student for life.

The No Child Left Behind (NCLB) Act is driving districts towards data-driven decision making. If “How are we doing in terms of NCLB?” is the only question, then your data needs are very specific. A bigger question for most districts is “How will we know that a student can [insert the district's mission, values, curriculum, etc.]?” If these are the kinds of questions on which you will focus, you will need to think carefully before you embark on building a system of data collection and analysis. These are big questions. You will almost certainly answer them in smaller pieces. Your data system will have to be able to capture numerous data elements as well as help you answer “big-picture” questions. It will need to be flexible enough to grow with you and yet not be cumbersome to use.

A good starting place is to define what the end product should do. Given your questions, describe or illustrate the kinds of answers you expect to help you decide what to do. Do not think of the minimum necessary. Describe useful answers and work out incremental steps to get to the goal. Data-driven decision making is about making sure you keep taking the right steps.

Questions Relating to Element B: Scope

- B1. Do you know the kinds of questions you will be trying to answer?
- No
 - Yes
 - Do not know
- B2. Will these questions be reasonably precise and become more precise as time goes by?
- No
 - Yes
 - Do not know
- B3. Will there be other kinds of questions?
- No
 - Yes
 - Do not know
- B4. Will students, parents, and community also be able to use (parts of) the system?
- No
 - Yes
 - Do not know

Interpretation of Responses

A “No” answer to the first question or “Do not know” answers to the other questions should stop you: More thought about what you want to know is necessary.

“Yes” answers suggest you are ready to move forward.

If you also can answer “Yes” without the words *kind of*, a more limited, more tightly configured system may be all you need now because your needs appear tightly focused. Still, be careful. Investments in data systems of greater generality are usually the better choice. On the other hand, it is possible to follow a pathway of growth over time in system functionalities. It is not necessary to do (or buy) everything at once. Discuss these matters carefully with system vendors to prevent dead-ends down the road.

The last question raises other issues. You probably will need to engage students’ entire network of support, including parents, community, and the students themselves. That implies wide but controlled access to the data system. It probably also implies that the data system will not be a single purchase, but rather grow into a “stack” of applications—that is, software components that provide a mix of well-integrated functions.

Element C: Risk

Introduction

In mutual fund and stock reports, the following footnote is common: “Past performance is no guarantee of future results.” Nevertheless, we make predictions all the time. Yesterday’s data lead to conclusions about tomorrow. History is interesting, but a teacher’s concern is the students in the room today and where they will be in June. The key question becomes “How confident are we of the predictions?” Data should paint a trustworthy path to the future.

Prediction should be *modeled*—that is, shaped by instructional choices carefully captured in data and rigorously analyzed. This is possible in schools and should be done more often. Careful modeling is all the more important when we recall the uncertainty in even a key outcome measure, standardized tests. In the fine print of the student reports sent out by test publishers, it says that individual scores fall in a range, not at a point. That range is surprisingly large, often more than 10 percent of the total scale or more than a half-year’s growth. Given such built-in uncertainty, modeling is necessary to “tune in” strong and trustworthy signals from the data. Decisions should be based on the signals in the data, not on the noise.

State and other large-scale tests lack the sensitivity to paint a detailed picture of a student’s full knowledge and skill. Because of volume, they are better at painting a picture of a district or school. If you need to track individual student progress, use multiple points of data over time on multiple measures. Require that the data system inform you of the level of confidence you should place in the computed results. One or two data points, no matter how compelling, are never enough. A trend line requires at least three data points, not two.

Teachers tend to think one child, one day, one lesson at a time; district leaders think about programs, school years, and beyond. The decisions made and the risks taken are clearly different. It is commonly assumed that a district’s chosen data system can speak meaningfully to both. That may be true, but not if the data system uses the same calculations, procedures, visualizations, and reports for both sets of purposes. Accurate rendering of the relevant meanings of the data for each set of purposes requires distinct procedures and specific reporting and visualizations. Consequently, risk assessments will vary.

Questions Relating to Element C: Risk

- C1. Do you want to know how the schools are doing or how the district is doing?
- No
 - Yes
 - Do not know
- C2. Do you want to know how individual students are doing?
- No
 - Yes
 - Do not know
- C3. Do you want to know how the schools or the district will do next year and subsequently?
- No
 - Yes
 - Do not know
- C4. Do you want to know how individual students will do next year and subsequently?
- No
 - Yes
 - Do not know
- C5. Can you estimate the amount of risk you run in the decisions you make, given the data you use?
- No
 - Yes
 - Do not know

Interpretation of Responses

Chances are you answered (or wanted to answer) “Yes” to the first four questions and “No” to the last one. However, keep in mind that while similar data-reporting procedures can address both student- and group-level questions, the warrants for decisions about action will be markedly different. Aggregation over individuals reduces statistical risk; decisions about individuals require multiple measures and multiple data points as well as sensitive interpretation.

Analytic and visualization techniques exist to provide better, more nuanced answers than those supported by simple bar graphs and pairwise comparisons. Prioritize your wants and needs. Demand that your data system comprehends and makes use of the complexity of education data in ways that increase signal and decrease noise. Require that data systems always indicate confidence levels, given data quality and analytic procedure. You *always* need to know how much trust to place in results.

Element D: Readiness

Introduction

Schools vary widely in the ability of their staffs to use data. Some have built strong cultures of data use, others not. What is clear is that data use requires time, training, and continuous support. Teacher-training institutions typically do not address data interpretation as a classroom skill. Graduate programs for administrators also provide little training in data applications or to support staff in learning data skills.

The phrase “Lies, damn lies, and statistics” was spoken in jest. (The quote often is attributed to Mark Twain, who claimed he got it from Benjamin Disraeli, although there is no record of Disraeli saying it. Statistics cannot resolve this.) Still, for many, statistics are a history of (t)error (Huff, 1954). The problem lies in how statistics are presented. The useful way is to hypothesize and test, as simply as this: Identify a problem, pose it as a question, research the question for what contributes to it, then measure performance. The size of the difference between measurement and benchmark combined with knowledge and experience will help you determine what to do. Statistics should help you see whether differences are meaningful. If they do not provide that help, turn to another basis for decision.

Data make change visible. Data provide an empirical lens that magnifies objective detail while distancing us from personality. Data can confirm if there is change or not. The smaller, the tighter, the more frequent the feedback loops that the data system supports, the more staff can make decisions, the more frequently decisions can be made, and the more likely that the decisions made will be better ones.

Data become information through conversations among staff members. These conversations reinforce the feedback loops fed by the information flowing from electronic data systems. Allowing these practices to take hold and become habitual requires time, training, practice, supervision, and leadership. Conversations about data always connect back to individual classroom practices or administrative decisions. An environment of mutual professional trust, a “safe space” so to speak, is therefore a necessary condition to enable these conversations.

Questions Relating to Element D: Readiness

- D1. What will be the level of budgetary support?
- Fixed, one-time amount
 - Fixed, multiyear amount
 - Flexible, multiyear funding
- D2. Who will be the effort's champions?
- None needed
 - Roles defined
 - Selected
 - Everyone
- D3. What technical staff will be needed for system deployment and ongoing support?
- Unsure
 - Role requirements defined
 - Selected
- D4. Will there be support for staff to ensure that data are used properly and in sound ways?
- No
 - Maybe
 - Yes
- D5. Who is available to guide the development and delivery of suitable training on the use of data for measurement, monitoring, and interpretation?
- None needed
 - Role requirements defined
 - Selected
- D6. Will there be support to help staff select, design, and implement new instructional strategies?
- No
 - Maybe
 - Yes

Interpretation of Responses

Without technical staff and without user champions (note the plural; note the advantages of “everyone”), the data system project will fail to meet expectations. Without training in data use and training in instructional applications, the data system itself will not meet expectations. Although sufficient time for training and for practice is always necessary, it is often overlooked. Without an adequate funding stream, the system's implementation and its supports will be insufficient. The specific details of the implementation work need not be well detailed at the beginning, but the will and the resources must be present.

Element E: Information Quality

Introduction

You have a good sense of your questions about students' learning. Now you must specify the data you will use. Resist making a list of the data you already have. Instead, figure out what data you need in order to persuade others to act.

For example, say that data show performance is well below target, but no one is willing to change because, after all, it is only one piece of data. How much more data will you need to make your case? What comparisons will compel someone to say that the original idea of low performance was correct?

In the end, if we do not like what the data say, one question remains: Is it bad data or weakness in our teaching and learning practices? The important realization is that in either case, we are in control, so by default we have to fix it (the data, or the teaching, or the learning)—this is the heart of accountability.

There are many possible challenges to data integrity, validity, reliability, precision, and meaning. Getting the technical parts of data quality right is complex, technical, and messy. Seek advice! (A good place to begin is the *Forum Guide to Education Indicators* from the National Forum on Education Statistics [2005].) Work to keep the technical details in the service of the larger purposes. Focus on the purposes for which you will use data, on the logical and rhetorical structures you need to build to make your case. Let technical experts lead the cleaning and loading.

Lay out a logical design for how you will use the data. Researchers call this a *theory of action*. It tells how things connect and how each influences the other. This theory should also describe why your school does what it does for teaching and learning. The data then model your beliefs and practices. With that modeling, data will help you see clearly what is working, what is not working, and where new effort is needed. Let the technical specialists build out the data warehouse to house the data elements that are needed to test your theory of action.

Strategic Questions Related to Element E: Information Quality

- E1. Do you know the information you will need?
- No
 - Yes
 - Do not know
- E2. Do you know when you will need that information?
- No
 - Yes
 - Do not know
- E3. Will the system readily accept additional data elements?
- No
 - Yes
 - Do not know
- E4. Do you know what processes will ensure that the data are accurate and valid?
- No
 - Yes
 - Do not know
- E5. Do you know how to ensure that the data will remain secure and confidential?
- No
 - Yes
 - Do not know
- E6. Do you know that inferences drawn from the data will be sound?
- No
 - Yes
 - Do not know

Tactical Questions Related to Element E: Information Quality

- E7. Do you know the data elements you have and where they are? Do you know what elements you still need?
- No
 - Yes
 - Do not know
- E8. Currently, do you have designated data owners, caretakers, users?
- No
 - Yes
 - Do not know

- E9. Do you know how much data cleaning will be needed? If there is much data, do you know the extract, transform, and load (ETL) priorities?
- No
 - Yes
 - Do not know
- E10. Do you know how frequently data will need to be updated?
- No
 - Yes
 - Do not know
- E11. Does the vendor’s data update schedule meet your analytic and reporting needs?
- No
 - Yes
 - Do not know

Interpretation of Responses

Quality ensures that users are confident and will trust the data. Data must be accurate, relevant, useful, and sufficient. This must be true at the level at which the data are collected and stored and for the re-combinations and re-groupings that will happen subsequently. Ensuring this requires sophisticated technical skills—even more so once data fields begin to proliferate, as they will.

That complexity must be transparent to the persons who will make decisions based on the patterns “read” in the data. Achieving transparency requires careful working together of those who design the questioning domains (you); those who collect, store, and manipulate the data (the technical experts, usually vendors); and your teachers and principals who will convert your “big” questions into data explorations that help them see what they need to do.

Element F: System Quality

Introduction

When introduced, a data system often generates a distinct reaction: “Cool!” What you really want, however, is for staff to ask a question and be able to point to data that support an answer or a way to an answer. When staff members become inquisitive, you want them to explore—these are moments similar to the teachable moments they look for in their own classrooms.

Staff members become excited using an analysis tool if it delivers what they need or if it answers their next question. During vendor interviews, you should ask questions that help you see whether the system will induce that excitement. Technical architectural details are all good and well, but use will be driven by the conversations staff can hold about the data and their analyses, not the technical details.

If staff members are excited and say things that make you realize they are thinking new thoughts, then you have made a good choice. Again, it is about data-driven decisions and actions that lead to greater productivity and performance.

If you want teachers to be active users of the data system, it is critical that the data system’s mode of presentation fits transparently into the routines of their daily lives. If the system requires 30 to 45 minutes of a staff member’s time to construct an analysis or explore a concern, staff will not use it much—unless you set aside such blocks of time. Systems that require much shorter contact times or present early warning indicators in a dashboard mode probably fit school life better, assuming the dashboard lights illuminate points of interest.

Such capacities ask for considerably more interactivity and programmability of an electronic data system than delivery of “canned” reports and graphics, even analytics. The questions that follow, therefore, focus on the capacity of systems to be nimble, quick, and useful under routine and novel situations.

Questions Relating to Element F: System Quality

- F1. Does the system interconnect and integrate the various data sources you use?
- No
 - Yes
 - Do not know
- F2. Does it meet the Schools Interoperability Framework (SIF) standard (a standard for data sharing supported by vendor serving the K–12 market) and the Open Database Connectivity (ODBC) standard (a data industry standard to let applications access data from numerous repositories)?
- No
 - Yes
 - Do not know
- F3. Does the system store data at the lowest possible grain size, given your needs?
- No
 - Yes
 - Do not know
- F4. Are all necessary metadata recorded and usable for queries?
- No
 - Yes
 - Do not know
- F5. Does the system permit flexible filtering and aggregation over units, over time, and among data elements?
- No
 - Yes
 - Do not know
- F6. Does the system provide capable and useful decision support and analytic tools?
- No
 - Yes
 - Do not know
- F7. Is there a route to enhance or extend the system’s decision support and analytic tools?
- No
 - Yes
 - Do not know
- F8. Is the system interface friendly, supportive, and informative?
- No
 - Yes
 - Do not know

- F9. Does the system interface support progressive disclosure in response to staff inquiries?
- No
 - Yes
 - Do not know
- F10. Will the system scale readily as user numbers increase?
- No
 - Yes
 - Do not know
- F11. Will system implementation time meet your needs?
- No
 - Yes
 - Do not know
- F12. Does the vendor provide adequate technical support?
- No
 - Yes
 - Do not know
- F13. Does the vendor provide training for instructional staff that connects clearly to your school and district mission and procedures?
- No
 - Yes
 - Do not know

Interpretation of Responses

You should seek as many affirmative responses to these questions as possible. No product currently can meet all these requirements, despite the fact that vendors will promise you their data systems will do (nearly) everything you ask. Your own understanding of some of the terms in these questions may be somewhat vague or uncertain today. Your skills and knowledge will grow. For now, focus on ensuring that product vendors can reply “Yes” to most of these questions. For each “Yes,” have the vendors tell you why it matters. In doing so, you will learn a great deal about the appropriateness of both the product and the vendor to meet your needs.

All the currently available electronic data systems for K–12 are adequate for storing and tracking student demographics, attendance, grades, assessment, and other basic data elements. Connecting these to student scheduling information and teacher attributes is much more difficult; usefully interconnecting these data elements to each other over time can also be problematic in many products. Thorough study of a product’s reporting and analytic capacities will tell you more of its utility for you than close inspection of technical underpinnings. Note whether the analytics focus on describing the past or predicting the future. Note carefully whether that description or prediction is grounded in raw data or modeled data. You count the latter—and you want to be able to see and alter the model parameters.

The acid test will be how much the system gets used and the quality of the decisions your staff make after use. Involve staff members beforehand in opportunities to review reports and queries, to see analyses and talk through their reactions and their predictions of their behavior. Ask them to spend time with demo or mockups the vendor may provide. Their reactions about potential usefulness and value should be a strong element in your decision making. Use these reactions to query the vendors further. Signs of flexibility, support, and meeting your needs straightforwardly will be clear markers of good future relations.

Element G: Impact

Just what is a data-driven decision? It will vary with the decisions you permit staff to make. Make sure all staff members understand what their core responsibilities are and what their obligations are for learning to do that work better. Understanding this will make a big difference in how staff will seek, manipulate, present, and use data. (A useful support is the *Forum Guide to Building a Culture of Quality Data* from the National Forum on Education Statistics [2004].)

The key is to understand which data are relevant, how data are structured and presented, and how big a difference must be before it provides researchable evidence for action. Are you prepared to support the data-driven actions proposed by staff? Will you allow them to experiment instructionally with data as their guide? Will you give them the necessary resources to explore and understand options and decide well?

A five-point theory of action supports the drive toward data-based decision making in classrooms, schools, and districts:

- *The purpose of data is to make change visible.* Data offer an objective lens, magnifying details sometimes unseen and distancing the more personal elements. This enhances richness of information and reduces ad hominem irrelevancies.
- *Change requires understanding.* Schools are “loosely coupled” settings—once doors close, staffs are largely in control of their own work. Therefore, each staff member needs to come to understand in personal terms what changes are necessary. At the same time, as each person arrives at an understanding about change, these understandings need to align around the core issues of instructional productivity. When this happens, cacophony becomes chorus.
- *Understanding requires feedback.* Data can confirm that change is happening, what the direction of change is, and what the rate of change is. The smaller (fewer people, fewer issues), the tighter (the quicker) the feedback loop, the more frequently decisions can be made and the more likely decisions will be accurate. Monitoring becomes continual improvement.
- *Information is social.* Data must be visible to all. Data must be and remain at the center of ongoing conversations about the work and its importance. Data convert into information through social interaction. Information is a shared good: It has no value when restricted to one person.
- *Change is local.* At bottom, change is an individual event: One person acts, then another. In schools, it is the school community—the conversing unit of interconnected individuals whose work is aligned because of common understanding—that breathes life into change.

Element H: Cost

The costs for acquiring, installing, maintaining, and operating an electronic data system are variable and difficult to pin down. In part, this is driven by the fact that data systems are not sold as commodities but are individually contracted between vendor and district. While installation, maintenance, and operational costs (and profit margins) are quite clear to the vendors, there are assorted uncertainties from the vendor's perspective that lead to variations in costs:

- *Data extraction, cleaning, and loading.* Data sources and data requirements vary from client to client. Commonalities do exist, such as commercial or state assessment records, but even these vary by depth and breadth and use preferences. Data that are digitally stored in warehouses today are typically fairly easily extracted, and the situation is improving. Nevertheless, local data and local data storage remain a confusing world and require considerable up-front effort to identify, structure, convert, and load.
- *Application stacks.* A decade ago, a district bought a single vendor's system and that was that. Today, multiple applications live side by side as well as in vertical stacks. Library and bus-routing systems are expected to feed select data elements to the instructional management data warehouse. Security applications and identity management software control user rights and access across multiple applications and multiple interfaces. Ensuring transparent connections and immediate access is no small task. Working out the relationships with a district's changing constellation of software and applications requires considerable and continuous effort, despite the industry's successful concentration on standards for data, interfacing, and control.
- *Client requirements.* Despite the apparent uniformity of school and district needs with respect to data and data solutions, vendors are continually surprised by the differences among districts in terms of what they want and need from data systems. Vendors do not want unsatisfied customers; however, if they do not understand what the customer really wants, contracts soon become uncomfortable.
- *Learning area.* Software can be installed. To make it useful and reliable often requires considerable learning by staff members. With experience, utility should increase. But escalating return on investment will depend on your own investment in and patience with your staff's learning—not to entertain your own ability to show the way.

In **Data Systems Resources** that appear in **Section 3: Resources**, there are several reports that include some pricing examples. See the following resources: College of Education, University of Texas at Austin (n.d.); Schools Interoperability Framework Association (2003); and Stein (2003).

Section 2: Tools for Facilitators



Using the Tools for Facilitators

Tools in This Section

This section consists of the following tools:

- Personal Reflection worksheets for six of the key elements:
 - Element A: Will
 - Element B: Scope
 - Element C: Risk
 - Element D: Readiness
 - Element E: Information Quality
 - Element F: System Quality
- Discussion/Facilitation Worksheet 1 for collaborative discussion
- Discussion/Facilitation Worksheet 2 for planning next steps

Instructions for Using This Section

Note: Everyone already should have worked through the questions for each element in **Section 1: Tools for School and District Leaders**.

First, as a group or as individuals interested in a data system, everyone should reflect on the key elements using the Personal Reflection worksheets that follow.

Next, using Worksheet 1, one member should facilitate a conversation around each element, and the exploratory team could come up with consensus on what is known and what needs more investigation. Alternatively, an individual could use the worksheet to organize his or her own thoughts in one place.

Then, use Worksheet 2 to plan actions for further investigation and dialogue.

Personal Reflection on Element A: Will

*Directions: Review your answers and the interpretation for **Element A: Will** (beginning on page 5). Then work through the following questions, and be prepared to share and collaborate with other members of the exploratory team.*

Summarize your sense of overall readiness in terms of **will** for moving forward with making a decision about electronic data systems.

Which questions suggest readiness? Please provide the question numbers and answers.

Which questions confirm areas of unpreparedness? Provide the question numbers and ideas about where someone might look for this information.

Personal Reflection on Element B: Scope

*Directions: Review your answers and the interpretation for **Element B: Scope** (beginning on page 7). Then work through the following questions, and be prepared to share and collaborate with other members of the exploratory team.*

Summarize your sense of overall readiness in terms of *scope* for moving forward with making a decision about electronic data systems.

Which questions suggest readiness? Please provide the question numbers and answers.

Which questions confirm areas of unpreparedness? Provide the question numbers and ideas about where someone might look for this information.

Personal Reflection on Element C: Risk

*Directions: Review your answers and the interpretation for **Element C: Risk** (beginning on page 9). Then work through the following questions, and be prepared to share and collaborate with other members of the exploratory team.*

Summarize your sense of overall readiness in terms of **risk** for moving forward with making a decision about electronic data systems.

Which questions suggest readiness? Please provide the question numbers and answers.

Which questions confirm areas of unpreparedness? Provide the question numbers and ideas about where someone might look for this information.

Personal Reflection on Element D: Readiness

*Directions: Review your answers and the interpretation for **Element D: Readiness** (beginning on page 11). Then work through the following questions, and be prepared to share and collaborate with other members of the exploratory team.*

Summarize your sense of general **readiness** for moving forward with making a decision about electronic data systems.

Which questions suggest readiness? Please provide the question numbers and answers.

Which questions confirm areas of unpreparedness? Provide the question numbers and ideas about where someone might look for this information.

Personal Reflection on Element E: Information Quality

*Directions: Review your answers and the interpretation for **Element E: Information Quality** (beginning on page 13). Then work through the following questions, and be prepared to share and collaborate with other members of the exploratory team.*

Summarize your sense of overall readiness in terms of *information quality* for moving forward with making a decision about electronic data systems.

Which questions suggest readiness? Please provide the question numbers and answers.

Which questions confirm areas of unpreparedness? Provide the question numbers and ideas about where someone might look for this information.

Personal Reflection on Element F: System Quality

*Directions: Review your answers and the interpretation for **Element F: System Quality** (beginning on page 16). Then work through the following questions, and be prepared to share and collaborate with other members of the exploratory team.*

Summarize your sense of overall readiness in terms of *system quality* for moving forward with making a decision about electronic data systems.

Which questions suggest readiness? Please provide the question numbers and answers.

Which questions confirm areas of unpreparedness? Provide the question numbers and ideas about where someone might look for this information.

Discussion/Facilitation Worksheet 1—Collaborative Discussion

Directions: After each member of the exploratory team works through each element and personally reflects on the questions and interpretations, it will be necessary to work with the team on a collaborative response in terms of readiness. For each element, reflect on the following questions to help guide a collaborative discussion and further data gathering around the use of a data system.

Element A: Will

Summarize the team's overall response to the survey questions.

Which of the questions is the district prepared to answer?

Which questions need more investigation and clearer answers? Where might we look for this information?

Element B: Scope

Summarize the team's overall response to the survey questions.

Which of the questions is the district prepared to answer?

Which questions need more investigation and clearer answers? Where might we look for this information?

Element C: Risk

Summarize the team's overall response to the survey questions.

Which of the questions is the district prepared to answer?

Which questions need more investigation and clearer answers? Where might we look for this information?

Element D: Readiness

Summarize the team's overall response to the survey questions.

Which of the questions is the district prepared to answer?

Which questions need more investigation and clearer answers? Where might we look for this information?

Element E: Information Quality

Summarize the team's overall response to the survey questions.

Which of the questions is the district prepared to answer?

Which questions need more investigation and clearer answers? Where might we look for this information?

Element F: System Quality

Summarize the team's overall response to the survey questions.

Which of the questions is the district prepared to answer?

Which questions need more investigation and clearer answers? Where might we look for this information?

Discussion/Facilitation Worksheet 2—Planning Next Steps

Directions: As a group, fill out this planning document for use in moving forward with exploring readiness to use an electronic data system. First, indicate the area(s) needing additional exploration. Then use the rest of the planning grid to lay out the details of the next steps. Finally, answer the questions at the bottom of the page.

Specific Next Steps

Areas of Additional Exploration	Timeline	Person(s) Responsible	Source(s) of Information

How will we sustain this effort? How will we share this information and move forward?

Section 3: Resources



Data Use Resources

Discussion

Arzberger, P., Schroeder, P., Beaulieu A., Gowker, G., Casey, K., Laaksonen, et al. (2004). An international framework to promote access to data. *Science*, 303, 1777–1778.

Summarizes the current situation with respect to data access, data sharing, and data for decision support in the international scientific community.

Bailey, J. (1996). *After thought: The computer challenge to human intelligence*. New York: Basic Books.

The core capacities of quantitative data are to tell us about place, pace, and pattern: where we are, whether we are moving and how fast, whether we are leaving anyone behind. As data tools and technologies improve, we to listen better. This requires new habits of mind.

Data Quality Campaign. (2005). *Creating a longitudinal data system: Using data to improve student achievement*. Austin, TX: National Center for Educational Accountability. Retrieved July 31, 2006, from <http://www.dataqualitycampaign.org/files/Publications-Creating Longitudinal Data System.pdf>

Describes and briefly analyzes each of the 10 essential elements of a state longitudinal data system, most of which also apply to district systems. Includes a brief overview of data system fundamentals.

Huff, D. (1954). *How to lie with statistics*. New York: Norton.

Classic review of how to use (and misuse) numerical data.

Platt, J. (1964). Strong inference. *Science*, 146, 347–353.

Early conceptual statement of the importance and power of data and incremental experimentation by practitioners. Platt argues that strong inferences about next steps are best powered by frequent, small-scale, trial-and-error experiments that rule out at least one possible “cause.” He reminds us this requires real rigor in thought and action.

Powers, R. (1999, April 18). Eyes wide open. *New York Times Magazine*, pp. 80–83.

Argues that the rise of the experimental method is the core “conceptual revolution that lies at the heart of what has happened to the world in these last 1,000 years.”

Tukey, J. W. (1962). The future of data analysis. *Annals of Mathematical Statistics*, 33(1).

Advice for a discipline at the prime of a career from a master in teasing meaning from numerical data.

Tukey, J. W. (1986). Sunset salvo. *American Statistician*, 40(1), 72–76.

Advice at the end of a career from a master: reduce dependence on assumptions, be prepared to accept that assumptions are wrong, increase impact of results for decision makers, take functional models (those that specify clear relationships) more seriously than stochastic ones (those that accept “random” relations among the data). Asking good questions that data can meaningfully address will become more difficult, not less.

Surveys

Consortium for School Networking. (n.d.). *How ready are you? A special tool for school district leaders to assess readiness to use data effectively*. Retrieved July 31, 2006, from <http://www.3d2know.org/assessment/survey.cfm>

Brief 10-item Web survey about readiness for data-driven decision making. Also available are a set of readings, links, and other resources.

Process Guides, Checklists

Learning Point Associates. (2006). *Information systems for school improvement: Resources*. Retrieved July 31, 2006, from <http://www.learningpt.org/page.php?pageID=31>

A website focused on school-level data analysis tools and resources to support better data use. The *Data Exploration* video is an excellent starting point.

National Forum on Education Statistics. (2004). *Forum guide to building a culture of quality data: A school and district resource* (NFES 2005-801). Washington DC: National Center for Education Statistics.

Brief document prepared by state-level data and data systems specialists, supporting the building of a continuous local culture of quality data and data use.

Data Systems Resources

Discussion

College of Education, University of Texas at Austin. (n.d.) *Data use: Improving education practice through data use*. Retrieved July 31, 2006, from <http://edadmin.edb.utexas.edu/datause/index.htm>

Maintained by Professor Jeff Wayman, this website is a rich resource on data use and commercial data products, including screenshots and comparisons.

Jackl, A., & King, S. (2006). *What's really "in store" for your data warehouse?* Austin, TX: ESP Solutions Group.

Too much emphasis can be placed on the data warehouse at the expense of the other components of a district's information system. A well-designed and implemented data warehouse can be quite powerful. But just as with any tool, it needs to be used for the right purpose. If an agency administrator is sold a data warehouse just to satisfy simple reporting needs, then resources have probably been wasted. If a data warehouse is overburdened with archive and reporting uses, then it will be unable to truly function as needed.

King, S., & Jackl, A. (2006). *What's behind your data warehouse?* Austin, TX: ESP Solutions Group.

Excellent overview of issues in designing a data warehouse for education, including scope: figuring out information needs and designing to meet them; reality: being practical about the questions to be answered and the data to be consolidated; and scalability: ensuring that the warehouse can grow to meet increased demand throughout the district but also additional data sets for better analysis and answers to questions that were not originally planned for.

Ligon, G. D. (2005). *Data management strategy for states and districts*. Austin, TX: ESP Solutions Group.

The yield from data and data systems should be high. Ligon's mantra—get the right data, get those data right, get them right away, get them the right way, manage the data right—clarifies numerous issues.

Sarmiento, J. (2003). *Technology tools for the analysis of achievement data: An introductory guide for educational leaders*. Philadelphia: Laboratory for Student Success, Temple University. Retrieved July 31, 2006, from http://www.nwrel.org/scpd/sslc/federal_grantees/cohort2/data_institutes/binder/resources/C2DataTechToolsforAnalysis.pdf

Brief introduction to data systems for education, data analysis, and vendor products (in 2003).

Stein, M. (2003). *Making sense of the data: Overview of the K–12 data management and analysis market*. Retrieved July 31, 2006, from http://www.eduventures.com/about/press_room/11_18_03.cfm (required log in)

Thorough review of the marketplace for student information systems (as of 2003), the players, and their distribution.

Wayman, J. C., Stringfield, S., & Yakimowski, M. (2004). *Software enabling school improvement through analysis of student data*. Baltimore: Center for Research on the Education of Students Placed At Risk (CRESPAR), Johns Hopkins University. Retrieved July 31, 2006, from <http://www.csos.jhu.edu/crespar/techReports/Report67.pdf>

Excellent introduction to the commercial and not-for-profit products available, including comparisons and evaluations of a select number of products.

Surveys

American Productivity and Quality Center. (n.d.). *Information technology within the organization* [Online survey]. Retrieved July 31, 2006, from <http://www.apqc.org/portal/apqc/site?path=/research/bmm/osbc/it/index.html>

Information technology organizations worldwide face the same challenge: doing more with less. APQC offers in-depth IT benchmarking and best practices that compare organizational processes and practices to relevant peers and world-class organizations in terms of costs, productivity, efficiency, and cycle time. Not education specific.

Andrews University. (1999). *Data warehousing readiness assessment*. Retrieved July 31, 2006, from <http://www.andrews.edu/ITS/AS/dw/Andrews/Questions.html>

A 60-item readiness survey, in the form of a simple list of questions.

Process Guides, Checklists

Ariyachandra, T., & Watson, H. (2006, January). Benchmarks for BI [business intelligence] and data warehousing success. *DM Review*. Retrieved July 31, 2006, from http://www.dmreview.com/article_sub.cfm?articleID=1044330

Describes metrics used to assess the success of data warehouse architectures and reports benchmark data for the metrics and their use. Focused on architectures applied outside education; however, the metrics and benchmarks may be readily adapted.

Assessment & Accountability Comprehensive Center. (2006). *Data tool selection criteria: Questions to consider when evaluating data tools*. Retrieved July 31, 2006, from <http://datause.cse.ucla.edu/datatool.html>

The Assessment & Accountability Comprehensive Center (whose Web address is <http://www.aacompcenter.org>) hosts a growing number of tools and resources for accountability. Under development is a series of supports for data-driven decision making and accompanying tools.

McIntire, T. (2004, May 15). Student information systems demystified. *School CIO*. Retrieved July 31, 2006, from <http://www.schoolcio.com/shared/printableArticle.jhtml?articleID=19400338>

Six points that simplify comparing commercial data systems, and brief comparisons of 10 systems.

McIntire, T. (2004, August 16). Eight buying tips: Data warehouses. *Technology & Learning*, 25(1). Retrieved July 31, 2006, from <http://www.techlearning.com/story/showArticle.jhtml?articleID=26806926>

Offers eight questions and seven attributes as guides through the process of selecting a product or finalizing a product design.

National Forum on Education Statistics. (2005). *Forum guide to education indicators* (NFES 2005-802). Washington DC: National Center for Education Statistics.

Prepared by state-level data and data systems specialists, this document provides detailed definitions, calculation formulas, and interpretations for the most common quantitative indicators used by schools, districts, and states.

Schools Interoperability Framework Association. (2003). *Implementation toolkit*. Retrieved July 31, 2006, from http://www.sifinfo.org/tool_kit.asp

Describes, in detail, how to plan for the implementation of Schools Interoperability Framework requirements.

References, Credits, and Acknowledgments



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- National Forum on Education Statistics. (2004). *Forum guide to building a culture of quality data: A school and district resource* (NFES 2005-801). Washington, DC: National Center for Education Statistics.
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The ESA Alliance is a group of representatives from Learning Point Associates and various educational service agencies (ESAs) from states throughout the Midwest region (Iowa, Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin) who have been engaged in an ongoing, collaborative alliance since June 1992.

Over the years, Learning Point Associates and the ESAs have attempted to create and put into operation both a “knowledge utilization system” and a “network” of governance and service delivery providers in the Midwest region.

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