

A Technology Framework to Support Accountability and Assessment How States Can Evaluate Their Status for *No Child Left Behind*

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Overview

The chief state school officer needs the right assessment and accountability data, right now—and the data better be right. Teachers and students need academic diagnostic data—on demand. How does the chief know if the state has the **information technology** in place to accomplish both goals? (Information technology is defined as the tools and systems used to share information, e.g., hardware, software, networks, and the processes to manage them.)

Each state's technology implementation can be unique. Each state can design the education information system best suited to its own requirements. Individual schools and districts can make personal choices of vendors and software applications. Even with this individuality across schools, districts, and states, each one can be aligned to meet their state's accountability and assessment requirements as well as those of *No Child Left Behind*. There is not one technology solution that fits all schools, district, and states.

States struggle with the “Education Technology Local Control Conundrum,” which is: How can local decision making about technology coexist with the requirements of a standardized state and national accountability system? The answer is adopting data and technology standards developed to enable **interoperability**. Interoperability is being able to share data electronically across different software applications, different hardware configurations, and different operating systems.

Each state's assessment and accountability systems will be judged on whether or not they provide data that yield maximum value. Every datum in these systems must be evaluated to ensure that it is worth the effort to get it and that it does the job it was collected to do.

Assessment and accountability systems cannot be successful without extensive technology support. Technology to support assessment and accountability requires a comprehensive, standards-based data exchange process (interoperability). There must be a smooth, timely movement of data from schools to districts to states, and on to the U.S. Department of Education (ED) with appropriate public access at each point. In December 2003, ED's **Performance Based Data Management Initiative (PBDMI)** successfully piloted a process for electronic state-to-federal data exchange. (See www.espsolutionsgroup.com/PBDMI.) PBDMI was developed using requirements described by the states themselves—requirements that leverage the capacity of each state to report data to the federal government or to efforts such as the Broad Foundation's partnership with USED (School Information Partnership, SIP).

To maximize data driven decision making (D3M), every state's mandated assessments must be administered, scored, reported, and acted upon within a **cycle time** of weeks contrasted with the months states took for less comprehensive assessment programs in the past. Mandated accountability reports must be compiled and published in an even shorter time to allow parents to make informed school choices, districts to make decisions on school improvements, and states to make school ratings.

All this must be accomplished with better data than states had before *No Child Left Behind*. The technology for all this is ready to be put into action.

A state must apply resources to technology-based solutions, because there is no other alternative that can deliver assessment and accountability reports on time. This makes technology's role in assessment and accountability that of providing the tools and the infrastructure through which data can flow quickly, accurately, and securely.

Technology and improved information systems will not make all this happen. People will make this happen with the intelligent use of technology. Today's technology tools can help solve a district or state's toughest information challenges. These challenges are described here very simply as getting the right data, in the right way, right away, and getting them right in the process. The right data management makes this happen.

States will not be held accountable for the technology they apply to *No Child Left Behind*. States will be held accountable for deliverables (e.g., adequate yearly progress determinations, annual report cards, diagnostic assessments aligned with academic standards and linked to the state's assessments, etc.) that are dependent upon the efficient use of information technology.

To assess a state's status in acquiring and applying technology to the necessary assessment and accountability components, the correct questions must be posed, measures that yield valid scores must be used, trends across time must be tracked, and benchmarks across states must be established. ED's PBDMI and its data resource, the **Education Data Exchange Network (EDEN)**, will be necessary resources. Emergent national standards for education data exchange (e.g., **Schools Interoperability Framework (SIF)**) will make the flow of data efficient. With these standards, states will be able to maintain their individualities and still be able to participate in the nationwide improvement of education data for assessment and accountability.

This paper will not leave states with only this 30,000 foot view of an ideal. Specific components for a state's information system, based upon best practices across all states, are described along with implementation benchmarks aligned with three familiar sounding "performance levels" (basic, proficient, and advanced).

The Vision for Our Data

Burden, redundancy, expense, lost productivity, lack of comparability, distrust, late reporting and other negatives have characterized education data for decades. Today's goal is to achieve **Max Yield Data**. Max Yield Data simply means data that everyone agrees are worth the effort. Imagine teachers, school administrators, program managers, and central office staff all agreeing that a required report yields such useful information that all the effort put into the collection and reporting of the data is worthwhile. Max Yield Data have been standardized, collected, and presented such that the maximum use can be made of them for decision making and reporting mandates. Reaching this goal demands high quality, managed accessibility, certification (sign-off that the data are correct and ready to use), interoperability, utility, affordability, and granularity (a level of detail that allows analysis and interpretation). (Ligon, 2003, *Best Practice for a State's Education Information System*, presented to chief state school officers, Lake Tahoe, NV.)



The mantra of reformers in the education data world as characterized by the members of the Council of Chief State School Officer's (CCSSO) Education Information Advisory Committee (EIAC) has been "collect the data once and use them many times, by many people, for many purposes." This has been the objective of states' and ED's efforts to automate data collections and to build data repositories.

The Steps

States have followed four steps to successful implementation of significant improvements in their technology supporting assessment and accountability information systems.

1. **Evaluate the Current Status:** A framework for this evaluation has been defined based upon direct involvement with and documentation of major efforts by states. Among the pioneers are Florida, Nevada, and Texas. In the latest generation with some new ideas are Iowa, Massachusetts, Mississippi, Oklahoma, Nebraska, Virginia, Wisconsin, Wyoming, and others. A self-assessment may be a good start, but tapping expertise beyond a single state education agency has been the typical approach. The National Center for Education Statistics sponsors a personnel exchange that has helped states share their expertise. A common approach has been to hire professional consulting firms for formal, independent evaluations.
2. **Identify the Gaps:** The difference between the findings of the evaluation and the benchmarks established through documentation of best practices across states provides a roadmap for improvement. This analysis should include a formal study of the requirements for a state's unique solution.
3. **Develop a Plan:** From the requirements study, a formal plan with timelines, budgets, and implementation benchmarks should be developed.
4. **Implement the Plan:** This may require a challenging commitment of resources, continual updates, and careful monitoring.

The Basics

There are five basic technology-based principles for achieving the Max Yield Data supportive of a state's assessment and accountability requirements. These can be viewed as the technology performance standards for supporting successful assessment and accountability systems.

1. *Get the right data.* Validity in an accountability system and specifically in an assessment program begins with a precise definition of what is to be measured and what method of measuring it is the most appropriate. *No Child Left Behind* requires a state's accountability system to be both valid and reliable. In the data world, this means creating common definitions for data elements (e.g., a **data dictionary**) to ensure that all providers of data report comparable data (same definitions, codes, and periodicity). Getting the right data begins at the school for most education data. Otherwise, nonstandard data (i.e., different definitions, incorrect entry, etc.) can be passed faithfully along throughout the information system, perpetuating the problem.
2. *Get the data right.* Data quality includes but goes beyond accuracy. As just stated, the data must be right from the beginning. All along the way, the data must be correctly exchanged. The proven

way to monitor this is with a set of business rules that describe the format, acceptable values, missing data options, and logical comparisons to prior reports. Automated processes that verify data upon entry contribute significantly to accuracy. (*Reducing Cycle Time and Increasing Data Quality for Student Assessments*, www.EducationAdvisor.info, Category: Data Driven Decision Making.) On the other end, access to data and formal reports must protect the confidentiality of individuals and be statistically reliable. (Confidentiality and Reliability Rules for AYP in NCLB , www.EducationAdvisor.info, Category: NCLB Requirements.)

3. *Get the data right away.* The lag time between testing and availability of the data limits the benefits of assessments and is an Achilles heel for assessments and *No Child Left Behind*. For any data to be useful and used for decision making, they must be current and timely. This is a major new accountability requirement for many state assessment programs. Cycle times of months to over a year were common prior to *No Child Left Behind*. Current assessment programs in which steps are linear and sequential (finish testing everyone, clean everyone's data before proceeding, then score all tests at the same time, then analyze results, then report statewide simultaneously, then publish all reports together, etc.) may not be the best model for today.

On-line, web-based testing is an effective best practice. The initiatives in progress in leading states should be watched to learn how to take on-line testing to the scale required for widespread implementation.

A major focus is replacing dissemination with access—making results available on demand rather than pushing them out to everyone at the same time. (*Implications for Collecting, Storing, Retrieving, and Disseminating National Data for Education*, Ligon, in U.S. Department of Education, National Center for Education Statistics, *From Data to Information: New Directions for the National Center for Education Statistics*, NCES 96-901, 1996.)

4. *Get the data the right way.* The right way to get data these days is through an automated process. Automated processes can verify data quality and ensure standards are met before data are accepted into the state's information system. States must understand that information exchange processes involve complex systems. For example, examining the complete process flow for student assessments clarifies that schools, districts, states, vendors, delivery services, printers, and web designers all have crucial roles in the process. Improvements at any single point in the flow may not be possible without coordination with other participants. (*The Supply Chain of State Assessments* and *Reducing Cycle Time*, www.EducationAdvisor.info, Category: Data Driven Decision Making.)
5. *Get the right data management.* The assessment and accountability systems must be managed well to achieve maximum yield from the data. Data management encompasses a broad range of administrative activities, infrastructure components, and policy commitments. A long-range plan for exchanging data should include policies, funding, human resources, enabling legislation, hardware, software, and networking. A policy advisory committee, a data provider group (user group), and an internal agency coordination group should oversee data management.

Defining Best Practice

Many states are managing many processes very well. Only a few are beginning to manage some of the more difficult processes well (e.g., reducing cycle time for reporting assessment scores). Even though there are 52 very different state-level education agencies mandated to follow *No Child Left Behind*, there is an **Education Information Technology Framework** with 10 **components** (necessary pieces of the infrastructure) that has been identified as representing best practices for a state. In the summer of 2004, visits to all 52 state-level education agencies documented their readiness for PBDMI and provided insights into each state's status on key components. (www.espsolutionsgroup.com/PBDMI)

These components had been identified in 2000 and 2002, when ED's Office of the Chief Information Officer sponsored a series of eight regional and national meetings to define the requirements for education information from the school to the district to the state to ED. Exploring how data move from the school secretary to the Secretary of Education, these meetings helped build a framework for describing a state's implementation of necessary components for accountability. (www.EducationAdvisor.info, Category: Data Quality and Best Practices.)

These 10 Education Information Technology Framework components can be used as a checklist for a state's self-assessment or as a starting point for a more formal, independent audit process. In the tables that follow, each component is defined and illustrated.

1. **Academic and Other Performance Standards:** Standards should describe in measurable terms the outcomes by which academic performance will be measured. Other areas (e.g., human resources, finance, support services, etc.) should also be held accountable using adopted standards and aligned measures. (Figure 1)
2. **Data Systems:** All required data should be included in the state's data systems. Statewide identifiers for students, employees, courses, facilities, programs, finance categories, etc. should be assigned. (Figure 1)
3. **Data Standards:** A comprehensive data dictionary should document definitions, codes, and formats to be followed statewide. (Figure 2)
4. **Data Quality:** Formal processes should verify the quality of data each time they are exchanged. (Figure 2)
5. **Aligned Assessments and Other Measures:** Assessments and other measures of outcomes should be aligned with the academic and other standards adopted. (Figure 3)
6. **Automated Data Systems:** Data should be collected, stored, and accessed using automated systems (e.g., directories, student/school management [student information system, SIS], discipline, program management, food services, transportation, library, finance, human resources, student performance [assessments], D3M [data driven decision making using a decision support system], instructional management). (Figure 3)
7. **Data Consolidation and Access:** Timely and easy access to data and reports should replace dissemination of reports. (Figure 3)

8. **Electronic Exchange of Records:** Records and data should be exchanged electronically among automated systems. Electronic systems should be interoperable rather than requiring translations at each step. (Figure 4)
9. **Network Connectivity:** Schools, districts, intermediate units, and state education agencies should be connected for fast and large data exchanges. (Figure 4)
10. **Technology Infrastructure:** Assessment and accountability systems should be supported by a technology infrastructure built on adequate resources and policy support. (Figure 5)

NOTE: NCES has published several documents that provide technical assistance to districts and states on best practice. Data definitions (Handbooks Online) are available at <http://nces.ed.gov/programs/handbook/>. Others include:

- U.S. Department of Education, National Center for Education Statistics. (2001). *Technology @ your fingertips: A Guide to Implementing Technology Solutions for Education Agencies and Institutions*, NCES 98-293. Washington, DC: Author. [Available at <http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=98293>]
- National Forum on Education Statistics. (2000). *Building an Automated Statewide Student Record System*, NCES 2000324. Washington, DC: U.S. Government Printing Office. [Available at <http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000324>]
- U.S. Department of Education, National Center for Education Statistics. (1995). *A Pilot Standard National Course Classification System for Secondary Education*, NCES 95-480. Washington, DC: U.S. Government Printing Office. [Available at <http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=95480>]
- U.S. Department of Education, National Center for Education Statistics. (1997). *Protecting the Privacy of Student Records: Guidelines for Education Agencies*, NCES 97-527, by Oona Cheung, Barbara Clements, and Ellen Pechman. Washington, DC: U.S. Government Printing Office. [Available at <http://www.nces.ed.gov/pubs97/p97527/index.html>]
- U.S. Department of Education, National Center for Education Statistics. (1998). *Safeguarding your technology: Practical guidelines for electronic education information security*. Washington, DC: Author. [Available at <http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=98297>]

Profiles of Prototypical States

Figures 1-5 use the accountability language of *No Child Left Behind* to describe implementation performance levels for each of the 10 Education Information Technology Framework components. The characteristics of various levels of successful implementation are categorized as **basic** (the legacy of a paper-based information world with separate information systems for every purpose; inadequate for a state's current assessment and accountability systems), **proficient** (the state of best practice needed to support assessment and accountability), and **advanced** (a higher level supportive of data driven decision making and enhanced support for students, teachers, administrators, and policy makers).

These checklists provide a framework for taking Step 1: Evaluate the Current Status of Technology Supporting Assessment and Accountability Systems.

Conclusion

Accountability is a process. Improvements will come from not only upgrading each of the 10 individual components of the Education Information Technology Framework, but also from changing how those components work together as an overall system.

Technology can be used to improve the processes within each of these 10 components. In fact, without technology, these processes cannot be fast enough or accurate enough to satisfy the requirements of a state's assessment system, a state's accountability system, or *No Child Left Behind*.

Four steps for achieving the technology support required for assessment and accountability systems have been defined. They are:

Step 1. Evaluate the current status of your state's information technology for the support of assessment and accountability systems.

Step 2. Identify the gaps between the current status and best practice as defined by the successes across all states.

Step 3. Develop a plan to close the gaps then to reach advanced levels of implementation.

Step 4. Implement the plan with the best data management practices.

The framework detailed in the 10 components within this paper provides the starting point for Step 1. The benchmarks established through the review of best practices across states provide the starting point for Step 2. Peer states can be an excellent resource for Steps 3 and 4.

Information technology processes and policies can be implemented in a unique way within each state. Sharing and using the lessons already learned across all states contributes to the best implementation for each state.



FIGURE 1 Performance Standard 1: Get the right data.

Component 1. Academic and Other Performance Standards

Basic Implementation

1.a. Performance standards have not been developed and adopted, or there are significant gaps in the standards.

1.b. Other areas do not have goals and objectives that are monitored and reported.

Proficient Implementation

1.a. Academic standards describe the skills and knowledge, and the performance targets for students. Performance standards have been developed and adopted for all academic areas. Standards are published and readily available.

1.b. Goals and objectives for all areas (students, staff, finance, support services) describe the non-academic outcomes targeted by the accountability system. Management processes may be different across areas and programs.

Advanced Implementation

1.a. An instructional management system links standards and detailed instructional targets with instructional resources and activities.

1.b. Management plans link resources, target dates, and dependencies. Plans are monitored and formal reports are published.

Component 2. Data Systems

Basic Implementation

2. Data systems are in separate "stovepipes" using different file standards without the capacity to share data across areas, offices, and programs. Decisions about which data to collect are made independently by districts, programs, departments, etc.

Proficient Implementation

2. A comprehensive process has been implemented to ensure that all required data are collected. Automated systems are implemented and aligned to collect and manage the data. Data systems are available for the full range of content areas (e.g., course data, program participation data, enrollment data, graduate follow-up data, assessments (statewide, diagnostic, college entrance, etc.), background and demographic data, staff data, financial data, etc.) Statewide identifiers for students, employees, courses, facilities, programs, finance categories, etc. should be assigned.

Advanced Implementation

2. A data driven decision making (D3M) system ensures that the data required are collected, stored, and accessible when needed for all approved purposes.



Figure 2 Performance Standard 2: Get the data right.

Component 3. Data Standards

Basic Implementation

3. Individual programs and offices determine the data element definitions and code sets they use.

Proficient Implementation

3. Data standards are adopted to establish a common definition for all data collected and reported.

3.a. A data dictionary is published to inform everyone of the up-to-date standards. All programs and offices comply or can crosswalk to it.

3.b. Alignment with national standards and federal requirements ensures that when the data are reported to other entities that they are comparable and usable.

Advanced Implementation

3.a. The state's data standards are available on the web in an electronic format that can be downloaded and imported into databases and applications.

3.b. Every database application has the capacity to meet data exchange standards (e.g., SIF)

Component 4. Data Quality

Basic Implementation

4. Data quality is not examined formally. Schools, districts, programs, and the state accept the data which are available as the best that can be provided with minimal feedback on the quality.

Proficient Implementation

4. Data quality is clearly defined, monitored, and required. Data quality is the responsibility of everyone at all levels of the education enterprise. Edit checks are performed each time data are exchanged.

Advanced Implementation

4. Data driven decision making is practiced with confidence in the data and reliance upon the data. Providers of the data rely upon them and ensure their quality.



Figure 3 Performance Standard 3: Get the data the right way.

Component 5. Aligned Assessments and Other Measures

Basic Implementation	Proficient Implementation	Advanced Implementation
<p>5.a. Student performance measures predate adoption of standards or are not customized to the state's standards.</p> <p>5.b. Other areas do not have formal performance measures.</p> <p>5.c. Reporting requirements for grants, federal funding, etc. are met at a minimal level, possibly with whatever data are available already.</p>	<p>5. Assessments and other measures are aligned with the accountability measures implemented.</p> <p>5.a. Items and objectives in the state assessments are mapped to the state academic standards.</p> <p>5.b. Performance measures for other areas (e.g., staff, finance, support services) are aligned with the goals and objectives targeted by the accountability system. Other areas have formal performance measures.</p> <p>5.c. Performance measures for grants, federal funding, etc. are met using data directly from statewide performance measures or from measures aligned directly with the requirements.</p>	<p>5.a. State assessments measure the instructional targets within the academic standards with established validity and reliability.</p> <p>5.b. Performance targets for other areas are sufficient to evaluate success and to support program improvement.</p> <p>5.c. Requirements for grants, federal funding, etc. are fully met with data sufficient to evaluate success and to support program improvement.</p>

Component 6. Automated Data Systems

Basic Implementation	Proficient Implementation	Advanced Implementation
<p>6.a. Paper forms are used to collect aggregate statistics. Forms converted to the web are not redesigned for efficiency. Validation of entries is minimal.</p> <p>6.b. "Stovepipe" data files are used.</p>	<p>6. Automated data systems collect and share the data efficiently.</p> <p>6.a. Collection systems are electronic, typically networked (on-line).</p> <p>i. The periodicity (as-of dates and time periods represented) of the data are clear.</p> <p>ii. Longitudinal data points are available for describing trends.</p> <p>iii. Entries are verified and error messages provided.</p> <p>6.b. The systems and their data are interoperable (i.e., capable of moving from one system to another without translation).</p> <p>6.c. Permanent, unique identifiers are assigned to students and staff to ensure matching of records.</p>	<p>6.a. Individual student and staff records are exchanged with the state where statistics are calculated. Web-based reports provide reports to districts and schools.</p> <p>6.b. Programs and offices at the state level access the data they need and are authorized to use. Automated updates of their files occurs as data are verified from schools and districts.</p>



Component 7. Data Consolidation and Access

Basic Implementation	Proficient Implementation	Advanced Implementation
<p>7.a. "Stovepipe" data files exist.</p> <p>7.b. Aggregate statistics are compiled by schools and districts and reported.</p> <p>7.c. Individual programs and offices manage their own data. A comprehensive data access and use policy is not adopted.</p>	<p>7. Data consolidation and access are efficient.</p> <p>7.a. A data repository, warehouse, etc. consolidates the data in a format that is well-documented.</p> <p>7.b. Linkable individual/unit records (e.g., students, staff, finance, programs) with unique, permanent identifiers allow separate pieces of data for the same individual to be linked and for related individuals' data to be correlated.</p> <p>7.c. Access to the data is managed carefully.</p> <p>i. Authority to access data and reports is defined for individual users related to specific data.</p> <p>ii. Reports meet the varied needs of the users (e.g., actionable accountability reports, diagnostic reports, ad hoc queries)</p>	<p>7. National standards and best practice across the states have been incorporated into the state's information system. Longitudinal analyses are possible using individual IDs, common course numbers, and standard directory data elements across years and files.</p>



Figure 4 Performance Standard 4: Get the data right away.

Component 8. Electronic Exchange of Records

Basic Implementation

- 8.a. Schools and districts assign local student IDs if they choose.
- 8.b. Schools contact prior schools by mail, phone, or e-mail to request transcripts, which are faxed or mailed. Mobile students are retested or services delayed until records arrive.
- 8.c. Data are entered separately into each software application (or paper records). Changes are made multiple times to each application.

Proficient Implementation

- 8. Electronic exchange of records avoids printing and/or re-entry of data across systems.
- 8.a. A student locator function allows schools to look up records for new students to find prior education records and student IDs. A unique, permanent student ID is assigned to all students and used in all data exchanges.
- 8.b. Student records (transcripts) move electronically between schools to speed placement and avoid re-assessment of mobile students.
- 8.c. The interoperability of systems allows for the immediate electronic exchange of data in all systems whenever updates are entered into one system.

Advanced Implementation

- 8.a. A web-based look-up application allows new students to be assigned IDs and mobile students' IDs to be verified.
- 8.b. A system is in place to move student records upon request from one school's database to another's. A statewide course numbering system is implemented.
- 8.c. Software applications are interoperable (by SIF or a custom exchange system) so each entry is shared across all systems.

Component 9. Network Connectivity

Basic Implementation

- 9. Schools and districts have disparate wide area network capability, some with dial-up or under-sized capacity.

Proficient Implementation

- 9. All schools and districts have network connectivity to each other and the state at speeds and capacity adequate for their normal work load.

Advanced Implementation

- 9. Schools, districts, intermediate units, and the state are all connected to the Internet (or private network) with T1 or better speed adequate for their peak work loads.



Figure 5 Performance Standard 5: Get the right data management.

Component 10. Technology Infrastructure

Basic Implementation	Proficient Implementation	Advanced Implementation
<p>10. The technology infrastructure is aging. Plans for required upgrades either have not been adopted or have not been implemented.</p>	<p>10. The technology infrastructure (the architecture and management of hardware, software, network, and data) is adequate.</p> <p>10.a. The technology infrastructure has adequate capacity for storage, compilation, and transfer of data.</p> <p>10.b. Confidentiality and security are ensured through both physical and process controls.</p> <p>10.c. The technology infrastructure is supported by the necessary policy, funding, human resources, and security.</p> <p>10.d. The state's legislature, education board, and education agency leadership have adopted the goals, enabling legislation, and funding.</p>	<p>10. The state's education agency leadership and staff have developed a long-range plan for information technology and architecture. This plan ensures that changes in requirements and technology are addressed on an on-going basis. The plan is fully implemented. Policy and user advisory groups actively monitor and support the data management processes.</p>