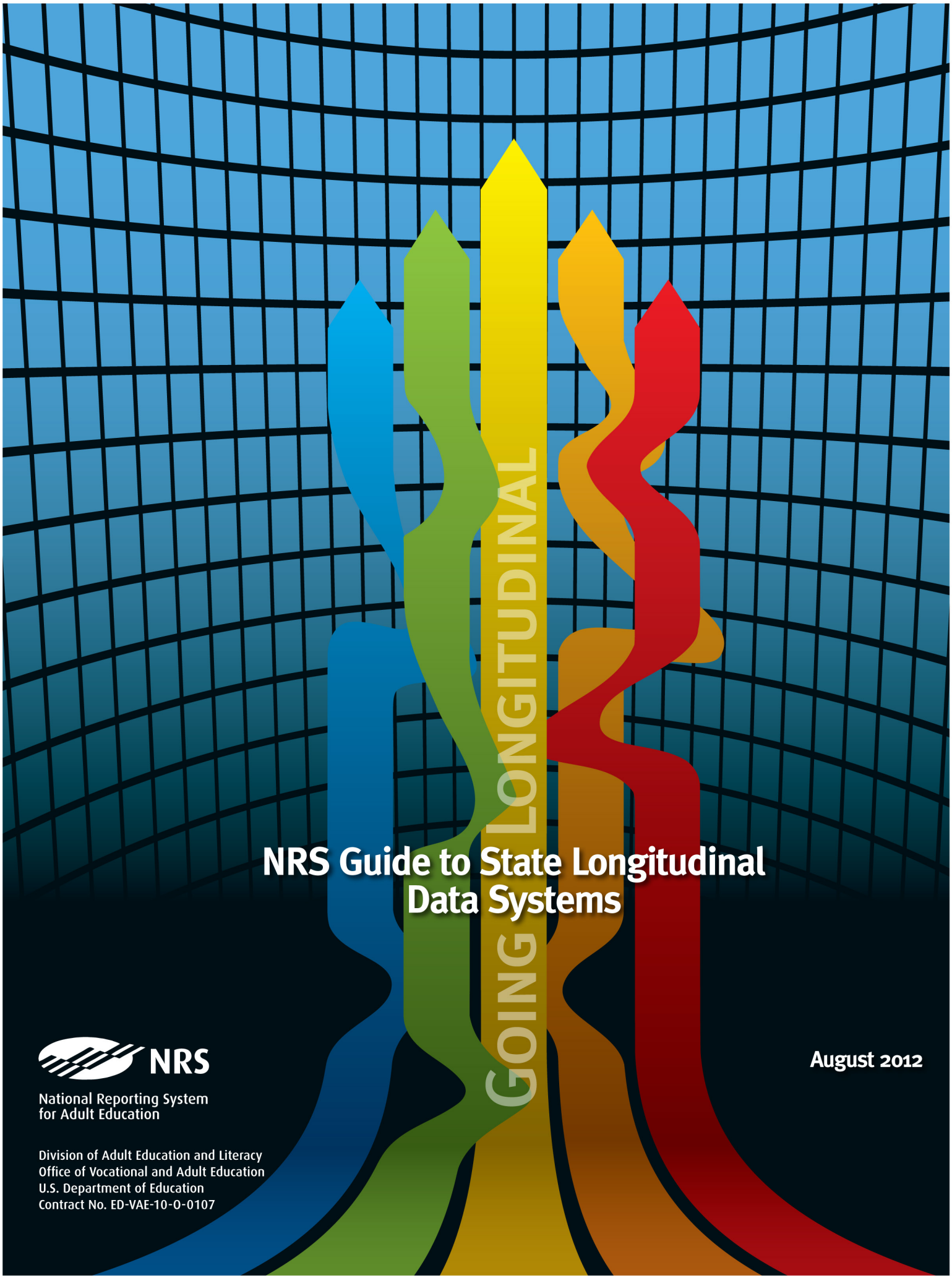

NRS Guide to State Longitudinal Data Systems

August 2012

NRS
National Reporting System
for Adult Education

Division of Adult Education and Literacy
Office of Vocational and Adult Education
U.S. Department of Education
Contract No. ED-VAE-10-O-0107

NRS Guide to State Longitudinal Data Systems

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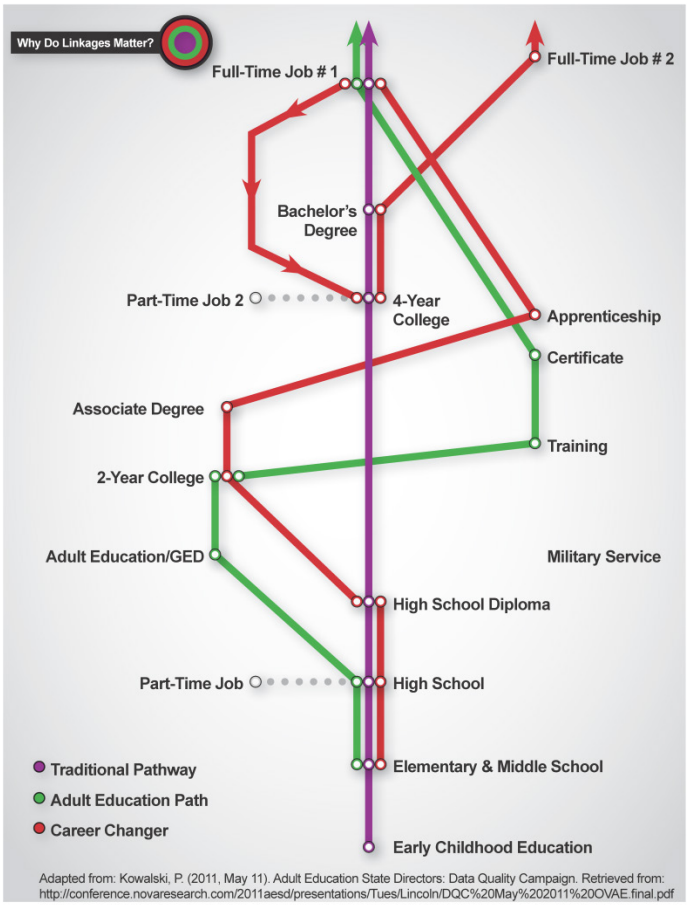
The rapid pace of economic, social, and lifestyle changes in late 20th- and early-21st-century America has led to a rethinking of approaches to education and career development. The linear educational path, in which students progress from preschool, elementary, and secondary school to college and employment, is no longer the main model for success. Out of choice or necessity, learners are exploring other pathways—through adult education, community colleges, and career and technical education programs—to employment and to becoming productive members of society.

Exhibit 1-1 shows three types of learners, only one of which follows the traditional pathway of school to college to work. The learner on the adult education pathway dropped out of high school but then attended adult education, passed the GED tests, and transitioned to community college. This learner then entered a job-training program, received a skills certification, and obtained a job. The career-changer learner took a more circuitous path, graduating from high school, receiving an associate's degree from a community college, then entered an apprenticeship program and obtained a job. This learner later decided to return to school to get a bachelor's degree and then got a different job.

Exhibit 1-1. Alternative Educational Pathways



Adapted from: Kowalski, P. (2011, May 11). Adult Education State Directors: Data Quality Campaign. Retrieved from: http://conference.novaresearch.com/2011aesd/presentations/Tues/Lincoln/DQC%20May%202011%20OVAE.final.pdf

Such pathways have become more commonplace, and with this increased complexity of educational services and pathways, there is a need to understand learners' skills, abilities, and needs across time and programs. While in the past, it may have been sufficient to know how many students graduated from high school, for example, it is now important to know how many of those graduates have transitioned to college and of those students, who graduated and whether they obtained employment. Likewise, we need to know about the outcomes of learners with different educational experiences. What other training and employment did those who did not complete high school or college obtain, how and in what sequence, and what were their outcomes?

The varied needs of learners have created greater challenges for policy makers and educators in planning and developing approaches responsive to learners' needs. At the same time, increased demands for accountability of education and training programs places enormous pressure on local federal and state programs to demonstrate their successes in helping learners achieve their goals. Data are necessary for planning and improving educational and training services, designing alternative approaches, and evaluating their effectiveness in promoting human development.

Over the last several years, there has been growing recognition of the need for longitudinal, multiagency state data systems, which can provide these data. The U.S. Departments of Education and Labor have awarded more than $400 million in grants in recent years to states to foster the development and use of state longitudinal data systems (LDSs). Foundations, notably the Bill & Melinda Gates Foundation, have provided additional funds to support state LDSs. The speed and intensity of these efforts, while furthering state LDS development, have had an unfortunate side effect of creating a confusing environment and often uncoordinated approaches and systems, even within the same state.

This guide is designed to organize these different programs and activities for developing a state LDS by providing definitions, organizing information about approaches and grants to support them, and by summarizing current state efforts and models. We focus specifically on the importance and role of adult education in the state LDS, and its connection to the National Reporting System (NRS), and we also describe ways to promote active partnership of adult education in these efforts.

State Longitudinal Data Systems

With the demand for accountability and availability of affordable software and computer systems, every education and training program has developed a database of descriptive and outcome information on its clients and learners. Schools systems, colleges, workforce agencies, and adult education programs all have their own sets of measures and data systems that can provide valuable information on their participants. However, such systems may have several drawbacks, including the creation of data silos specific to individual programs. While there may be rich data about a participant experience in one program, there is little or no information about subsequent or prior activities and achievements in other programs. Individual systems may also have limited longitudinal information or be able to provide only cross-sectional analyses on groups of participants, and are often incapable of disaggregating data by important participant characteristics.

For example, using NRS data, adult education programs know the percentage of students who complete educational functioning levels (EFLs), the number who get secondary credentials, and each student's attendance hours. However, the NRS system alone will be unable to provide data on students' educational experience before adult education enrollment or their later educational or employment outcomes. Nor could the NRS data system alone allow state staff to disaggregate the data to follow the educational or employment pathway of individual students and groups of learners through time and other programs.

Defining State Longitudinal Data Systems

A state LDS is designed to overcome the shortcomings of program-specific, cross-sectional databases, to provide richer information and analyses, using multiple variables over time. The National Center for Education Statistics (NCES) defines a state LDS as a:

> . . . data system that collects and maintains detailed, high quality student and staff-level data that are linked across entities over time, providing a complete academic performance history for each student and makes these data accessible through reporting and analysis tools (p. 7).[1]

Many states have data warehouse systems that appear to meet this definition because they have multiple years of data or other features characteristic of LDSs. These warehouse systems are not complete longitudinal systems, however, because they can provide only snapshots of groups of students over time. With NRS data a state may be able to use a data warehouse to report its EFL completions, the percentage of students who obtain employment, and enter postsecondary education and training over time. While such information is valuable, a data warehouse model cannot address such questions as:

- Did students who passed the GED enroll and progress in community college?
- Did unemployed, low-level ESL students obtain employment? Did they enter adult basic education (ABE) classes?
- How many ESL students obtained a GED? Did any of these students enter community college or improve their employment?
- What was the prior educational experience of students who entered adult secondary levels? How did they perform in high school?
- What was the employment history of ABE students before they enrolled? Did they find improved employment after exit?

State LDSs are unique in their ability to answer these types of questions because they have the following characteristics:

- Individual student-level data
- Teacher- and staff-level data
- Inclusion of these data from multiple educational and training programs
- Data across time
- Retrieval and analytic report capabilities to link these data

With these features, state LDSs can provide information that allows an understanding of students—who they are, their past educational experiences and current needs, and what they've learned and achieved and their employment experiences. An LDS goes beyond meeting data needs for reporting and accountability because it provides high-quality, timely, and relevant data to use

[1] National Forum on Education Statistics. (2010). *Traveling through time: The forum guide to longitudinal data systems. Book One of Four: What is an LDS?* (NFES 2010-805). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

for program improvement efforts. With better data, state staff can ask deeper questions about policy, practice, and student learning and achievement for planning and evaluation.

The ability to aggregate and disaggregate data at all levels is what makes an LDS so powerful. Because of the existence of individual student records from multiple sources over time, a state LDS user can follow an individual student or groups of students by demographic or other characteristics, or by services received. Users can also aggregate data in multiple ways to look at classes, teachers, programs, schools, counties, districts, and the state level. The LDS user is only limited by the extent of data in the system. With more agencies involved and longer time periods, users can answer deeper and more complex questions.

History and Legislation

While the idea for state LDSs has been around for many years, the Educational Technology and Assistance Act of 2002 was the first federal authorization of a state LDS grant program. Advances in technology and software have made the development of such systems more affordable and attractive over the last 10 years, and development efforts received an additional boost with the formation of the Data Quality Campaign (DQC) in 2005. This nonprofit organization provides technical assistance, materials, and information to promote the development and use of state LDSs for education. The DQC also provides guidance on navigating political structures within states to pave the way for adoption of an LDS. The DQC receives support from national educational research and policy institutions, teachers' unions, and foundations, including the Bill & Melinda Gates Foundation. Although the DQC does not explicitly address adult education, the materials and other resources developed and available on the DQC website (http://www.dataqualitycampaign.org/) are applicable to adult education.

Among the most substantial contributions of the DQC is the development of its 10 essential elements of an LDS for prekindergarten through 12th-grade (P–12) education systems. These elements have guided state LDS development in educational settings. In 2007, the America COMPETES Act formally defined a similar set of required state LDS data elements, adding two more for postsecondary institutions (see Exhibit 1-2). The act also continued the state grant program to support the development of LDSs and expanded them to cover postsecondary education (P–16).

Exhibit 1-2. Essential Elements of State Longitudinal Data Systems

P–12 and postsecondary education	P–12 only	Postsecondary education only
1. Unique student identifier that maintains confidentiality	6. Annual test records	11. Student transition success data and enrollment in remedial education
2. Student-level enrollment, demographic, and participation	7. Data on untested students by grade and subject	12. Data to assess adequate preparation for postsecondary success
3. Student-level data on completion, transfer, and dropout	8. Teacher identifier that can match teachers with students	
4. Ability of system to communicate with other systems	9. Student-level transcript information	
5. Audit system to assess data quality	10. Student-level college readiness test scores	

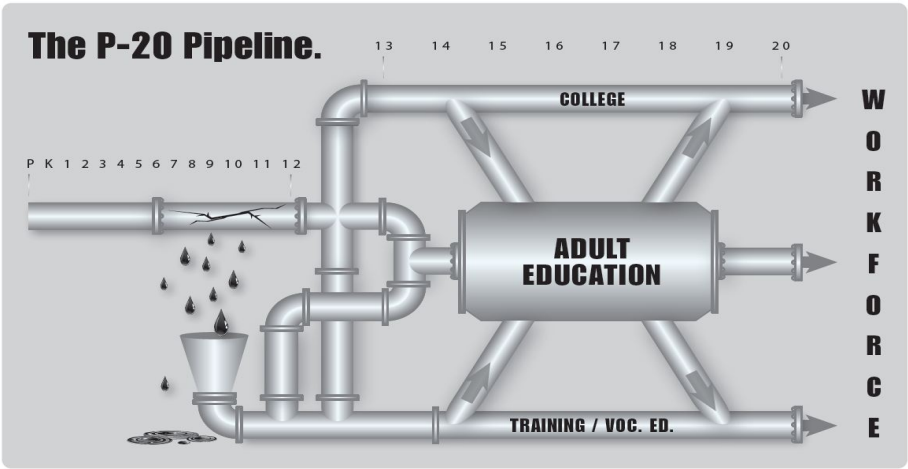
The state LDS grant program continues with funding authorized through the American Recovery and Reinvestment Act (ARRA) and competed through the Institute of Education Sciences (IES). As of 2010, 41 states and the District of Columbia had received at least one grant, for a total of more than $80 million to states over the last 2 years. The U.S. Department of Labor (DOL) recently began its own state LDS grant program, the Workforce Data Quality Initiative. Grant funds, awarded to 12 states, enable them to build or expand longitudinal databases of workforce data that also link to education data. DOL awarded 13 states grants in 2010 and announced a new completion for additional states in 2012. The DQC identifies 10 additional sources of federal funding that support state LDS development, including Race to the Top, the Teacher Incentive Fund, and the Workforce Innovation Fund (http://www.dataqualitycampaign.org/build/fedfunding).

LDSs and Adult Education

Although the legislation and grant programs supporting development of a state LDS now include all levels of education, including postsecondary education and workforce training programs, adult education is often not explicitly mentioned. The interstate variation of adult education's administration and governance—within departments of education, labor, or the community college system, for example—often makes it difficult for outside funders and policy makers to understand and define. Whether adult education is included in an LDS often depends on the politics or on personal relationships and idiosyncrasies of state staff. Unfortunately, this means that adult education is often left out of many discussions about state LDSs.

This should not be the case. Adult education holds a vital and unique place within states' educational and training systems. Unlike other programs with a narrower focus, adult education serves a diverse group of students with multiple goals, backgrounds, and skill levels. Adult learners include immigrants with little English-speaking ability, some of whom arrive with little prior education; youth who are disconnected from their education but who seek secondary credentials and want to transition to college; adults who need to upgrade their skills to improve their employment; and others who want to improve their literacy and language skills for personal reasons. Adult education catches all those adults whom other systems cannot serve or have been unsuccessful in meeting their needs. As depicted in Exhibit 1-3, adult education is a central part of the P-20 educational system, catching learners who drop out of traditional education and preparing learners for college, vocational education, and the workplace.

Exhibit 1-3. Adult Education in the P–20 Pipeline



State LDS Data for Accountability and Program Improvement

Being involved in an LDS will certainly help in meeting NRS reporting requirements for measures of employment and entry into postsecondary education. As reporting requirements change and focus more on postprogram outcomes, data from LDSs will allow states to meet these requirements with better quality data. However, meeting NRS requirements is not the main reason to become part of a state LDS. Improving the quality of education and outcomes, through better understanding of students and data-driven program improvement, is the real reason for a building and maintaining a strong state LDS.

State LDSs differ in the type of data they include, the agencies that are involved, and the time period the LDSs cover. However, they can help answer questions about individual students or groups of students, teachers, or classes, and can address questions about policies, programs, and strategies. Exhibit 1-4 lists examples of the types of questions that data from a state LDS can answer.

Exhibit 1-4. Examples of the Types of Questions That Data From a State LDS Can Answer

Questions about students	Questions about teachers and classes	Questions about programs and policy
1. What was the prior educational experience of students who entered adult secondary levels? How did they perform in high school?	1. Do students of teachers with more experience have better test scores and level gains consistently over time?	1. Does a managed enrollment policy result in higher student retention?
2. What was the employment history of ABE students before they enrolled? Did they find improved employment after exit?	2. Which teacher characteristics correlate with multi-year educational gains for low literate students?	2. Do students in integrated employment and training programs have higher levels of employment?
3. Did unemployed, low-level English as a second language (ESL) students obtain employment? Did they enter ABE classes?	3. Does the state's requirement for annual professional development for teachers relate to student outcomes?	3. How many students in postsecondary transition classes enter community college?
4. Did students who transitioned to postsecondary education take developmental education classes?	4. Do students in classes with more instructional hours transition to postsecondary education a higher rate?	4. Do programs with mostly full-time teachers have better student outcomes than those with mostly part-time teachers?
5. Did students who passed the GED enroll in community college?	5. Do students in classes focusing on job skills achieve higher employment rates than students in classes that focus on other topics?	5. Does performance of programs differ according to the instructional materials and approaches used?

Overview of Guide and NRS Training

This guide will explain the development and use of a state LDS from an adult education perspective. Chapter 2 describes the necessary elements of an LDS, including data elements and technical requirements. That chapter also describes an enterprise architecture design that serves as the framework for LDSs. The chapter also presents four LDS models and compares their advantages and disadvantages, along with a summary of challenges to system development.

In Chapter 3 we present an approach toward getting adult education involved in state LDS efforts through social marketing by making a business case and communication plan for potential state partners. The chapter concludes with a summary of funding opportunities available for LDS system development and maintenance.

Chapter 4 describes experiences of five states in developing and using LDSs, including details of how adult education became involved and its role in the system. Chapter 5 concludes the guide with examples of how to use state LDS data in research to address policy and programmatic questions, and then ends with suggestions for future development of state LDSs.

This guide is the 12th in a series of guides designed to assist states with implementing NRS requirements, improve data quality, and use NRS data to promote program improvement. This guide is unique among others in the series in its focus on development of LDSs, but it maintains the goal of improving state data quality for NRS reporting. It is designed to support national training on LDSs in adult education, conducted in June and July 2012, and accompanying materials.

The NRS support project staff at the American Institutes for Research (AIR) developed all the NRS guides through the Office of Vocational and Adult Education (OVAE)-funded projects that support the NRS. Readers interested in further information about the NRS and more information on data quality and the use of NRS data for program management and improvement should consult *NRSWeb*, the project website, at http://www.nrsweb.org/pubs/#trainingGuides, to obtain copies of these resources. The website also has training materials for all previous guides.

Chapter 2. Building a State Longitudinal Data System

Developing a longitudinal data system (LDS) is a complex and challenging project, requiring both technical expertise and nontechnical elements. The technical expertise encompasses the system's characteristics and capabilities, while the nontechnical elements include needs assessment, building support, professional development, and many other steps that lead to the development of a successful system. When developing an LDS, the nontechnical elements must be considered prior to, or in tandem with, building the data system itself. We will address these nontechnical elements in Chapter 4, using the experiences of several states. In this chapter, we review the technical elements, including system design and architecture, necessary data elements, and challenges.

Necessary Features of a State Longitudinal Data System and the Development Process

Building Your LDS

Building a state LDS is a collaborative process requiring several agencies to cooperate. While the goal of your LDS planning project is the construction of a cohesive system and consistent comparable data across education domains, each stakeholder agency will bring its own needs and interests to the planning discussion. Adult education practitioners may want the LDS to examine and understand a new student's educational background or workforce program outcomes. State-level policy makers may want to look at postsecondary student success rates following a particular K–12 course of study in a specific demographic group.

Exhibit 2-1. Data Elements for a State Longitudinal Data System

Student data	
Personal and demographic information • Unique student identifier • Sex • Date of birth • Race • Ethnicity • Language • Economically disadvantaged status • Limited English proficient (LEP) status • Title I status (or schoolwide status) • Migrant status • Homeless status • Disability status • Parent education level • Truant status	**Enrollment information** • Campus of enrollment • Grade level • Attendance/truancy data **Attainment information** • High school graduation • Diploma/credential type • School dropout • Dropout follow-up • Grade progression and retention • NRS Educational functioning level **Transcript/curriculum information** • Course codes and descriptions • Completion grades • Dual enrollment courses • Attendance hours in adult education
Program participation information • Bilingual/ESL program • Gifted and talented program • Early childhood program • Individualized education program (IEP) • Special assistance program	**Other information domains** • Student health and nutrition • Safety and discipline • Transportation data (e.g., length of bus ride) • Family history • Library records (e.g., books checked out)

Exhibit 2-1. Data Elements for a State Longitudinal Data System (continued)

Student data (continued)	
Performance information • Assessments (summative, formative, and interim) in K-12 and adult education • Untested student records • College readiness data (AT, SAT, and ACT scores) • Grades • Credits earned • Awards (e.g., diplomas) • Employment postsecondary entry and performance measures	• Meal data • Perceptions data (e.g., student–teacher relationships, school climate) • Fidelity of implementation (of programs and strategies)
Teacher and staff data	
Personal and demographic information • Unique teacher identifier • Date of birth • Sex • Ethnicity • Race **Qualifications information** • Years of experience (by location) • College attended/certifying institution • Highest degree earned • Academic major and minor • Highly qualified status • Graduation (with dates) • Certifications (with dates) • Licenses • Endorsements • Staff assessment results (e.g., subject knowledge test scores)	**Professional development information** • Professional development training (e.g., record of in-service credits, type of training) • Hours of professional development **Personnel information** • School identifier • Job/subject assignments (e.g., teacher, librarian) • Program assignment (e.g., special education) • Position title and codes • Teacher evaluation data • Schedules: grade/course/period taught • Compensation (e.g., salary, benefits, supplemental contracts) • Employment status (full-time equivalency, start/retirement/leave dates) • Time spent on administrative duties • Tenure • Mobility and attrition data
School system data	
Finance information • Revenues and expenditures • Salaries and benefits • Facilities and technology information • Building identifiers • Building area and space utilization • Building condition • Classroom type (e.g., conventional distance learning) **Organizational information** • School • Accreditation • Relationship between schools • District- and school-level directory data	**District demographic information** • School size • Class size • School safety • Adequate yearly progress (AYP) **Community demographic information** • Locale • Adult education levels • Income single parent households • Property values • Labor force data

Source: National Forum on Education Statistics. (2010). *Traveling through time: The forum guide to longitudinal data systems. Book Two of Four: Planning and Developing an LDS?* (NFES 2010-805). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

While particular system functions may be influenced by stakeholder needs, the availability of different kinds of data will inspire other uses. Exhibit 2-1 offers a list of suggested data elements

that you might want to include in your LDS. While these data elements are K-12 focused, an LDS that includes adult education would also have information about NRS measures (e.g., educational functioning levels, test scores) and measures of post program outcomes, such as employment and entry into postsecondary education.

Factors That Affect Design

Determining the size and shape of an LDS requires an understanding of a number of key technical, operational, and organizational factors that shape its design. Planners should explore the following:

- Specific uses for the system (research, policy analysis, student case management, etc.)
- Degree to which participating organizations' needs are similar/different
- Ease with which participating organizations can collaborate
- Number of participating organizations
- Technical, operational, and organizational similarities/differences of organizations sharing data
- Methods available for organizations to share data
- Characteristics of data available for sharing
- Need for agencies to control and manage their data
- Data security and student privacy considerations
- Levels of data accuracy and timeliness required
- Available funding

LDS systems will need to support the quick and easy interchange of data across organizations, a concept known as *interoperability*. Interoperability enables data *portability*, meaning that individual student records can be shared and used in any school (K–12, adult education, workforce or postsecondary) within the same state or even beyond.

The manner in which an LDS achieves interoperability and portability of student records data depends on how system designers address the considerations listed above. The selected approach is embodied within system architecture, a blueprint for building tools and technologies on which the system is constructed.

Framework for Analyzing Requirements: Enterprise Architecture

To understand the range of system requirements, an LDS planning group can examine elements of the community's e*nterprise architecture* (EA). An EA is a blueprint that your state agencies can follow to organize planning and enhance communication on the process. The EA focuses the attention of planners on key characteristics of the organization and information that supports its work. By looking at each component of the organization's EA—business architecture, information architecture, applications architecture, data architecture, and technology architecture—the functionality, operational priorities, and constraints of the plan become clearer.

The National Forum on Education Statistics[2] articulates five elements of enterprise architecture:

- **Business architecture:** what the participating organizations do (individually and together), and how they achieve their mission
- **Information architecture**: what information is necessary, where it comes from, and how it is maintained
- **Applications architecture:** how information is presented, used, and shared within the enterprise
- **Data architecture:** how data are conceptualized, understood, and applied
- **Technology architecture:** technologies that support data management, security, and usage

Your state's decisions regarding its EA will help shape the type of system model you select.

Model Longitudinal Data Systems

States are in varying stages of development of their LDSs, and several types of system architectures and hybrids have emerged. In this section, we describe four possible models that state adult education staff may consider in creating an LDS with their partner agencies. These models serve as archetypes that reflect the types of systems found in a review of state LDS efforts to date. We offer examples of actual state models of LDS in Chapter 3.

- **Linked data systems.** With this model, agencies maintain separate data systems and offer linkages to partnering organizations for reporting or operational activities. The agencies are loosely linked through data protocols and interagency agreements, such as memorandums of understanding (MOUs).
- **Federated data systems.** Like linked data systems, this approach requires each agency to maintain its own database; however, queries are made through a central unit that draws real-time data from the partner organizations on request. The connections and data sharing are more formalized and automatic.
- **Data warehouse model.** In this model, agencies will maintain their own data system and submit their data to a common central repository for analysis and reporting**.**
- **Integrated data systems.** This type of system creates a single, shared database for entering, reporting, and analyzing student records across agencies. In this model, all agencies use a single system for data entry and retrieval.

These model architectures offer insights to inform your approach to the development of an LDS. Consider the following descriptions and possible applications as you determine the model that may work best with partner agencies in your state.

[2] National Forum on Education Statistics. (2010). *Traveling through time: The forum guide to longitudinal data systems. Book Two of Four: Planning and Developing an LDS?* (NFES 2010-805). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Linked Data Systems

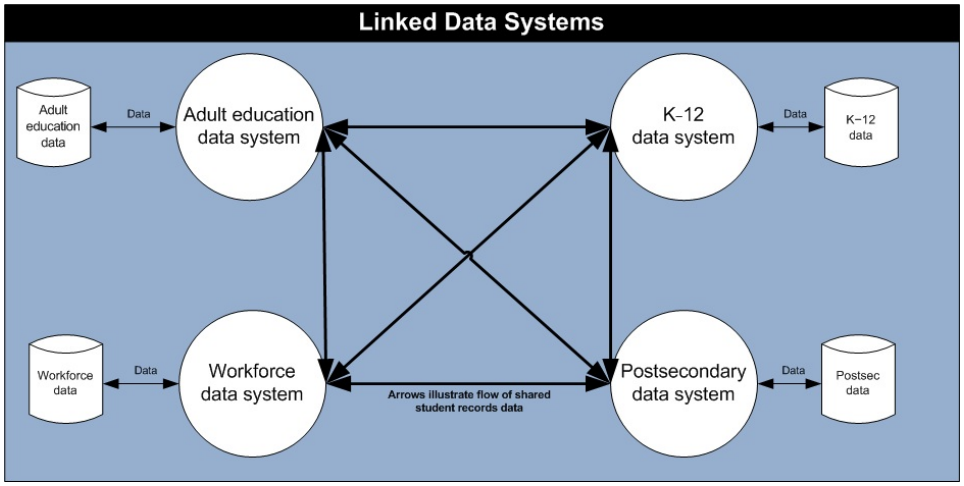
Under a linked data system model, different agencies maintain their own data systems but offer linkages between their systems and partnering organizations. For example, an adult education data system might provide student information to community colleges; school districts might share student-level data with adult education systems.

Because linked data systems often feature specialized data linkages and may not need to rely on a particular standardized protocol for data sharing, this model can often be set up quickly. However, as the number of participating organizations grows, so do the challenges of maintaining data transfer links and conversion of data among formats to assure meaningful interpretation. As a result, the linked data system model can create challenges in communication across agencies as the number of participating organizations increases. In other words, this model tends not to "scale up" well.

In addition, while linked systems share data, they do not offer reporting, analysis, or other data retrieval features. As a result, organizations in a linked system must develop their own tools for using the data that they receive from a partner. Data use features are usually integrated in each agency's data system.

For states starting along the LDS path, a loosely connected group of systems offers a way to demonstrate progress quickly. A more advanced effort would require consideration of standards for matching/ integrating data, addressing data security and privacy issues, providing consistent interoperability, and maintaining a more robust and reliable technology platform. Exhibit 2-2 shows how four independent systems might be connected as part of a linked data system.

Exhibit 2-2. Linked Data Systems Model



Federated Data Systems

A federated system is similar to a linked system in that data from multiple organizations can be combined into an enterprise-wide virtual student records repository. A federated system electronically brings together data from individual agency databases—on demand. As a result, reports and analyses from a federated system can draw from the latest available data. At the same time, participating organizations retain greater control over their own data because it remains in

their own system's database until it is needed. Each agency is responsible for cleaning, validating, and maintaining its own records in its respective database.

Federated data systems differ in key areas from linked data systems. Both types of systems pull down data real time from external sources. However, federated systems offer a well-defined, consistent, and replicable method for sharing data and also a systematic means for combining data drawn from different sources. This makes federated systems capable of accommodating more participating organizations, thereby allowing for a richer, more comprehensive LDS.

While federated systems can deliver up-to-the-minute student case management, their use of live (not necessarily fully validated or updated) data may not deliver the data quality necessary for robust reporting and analysis. However, federated systems offer quick and efficient data retrieval. The tradeoff between accuracy/completeness and speed should be driven by anticipated uses of the system. In addition, the federated systems model requires users who submit queries to request permission from each agency that will provide data.

Standardized methods make it easy to integrate data from external databases to form a federated system. However, technologies to validate requests and combine disparate datasets are more complicated. Rules for linking student records and combining data must be established and codified in a metadatabase to allow dynamic creation of needed data sets. Nevertheless, the federated model enables individual agencies to maintain control over their own data, minimizes the ongoing task of linking and sharing student records, and accommodates the addition of new organizations over time. In short, it scales up well.

Exhibit 2-3. Federated Data Systems Model

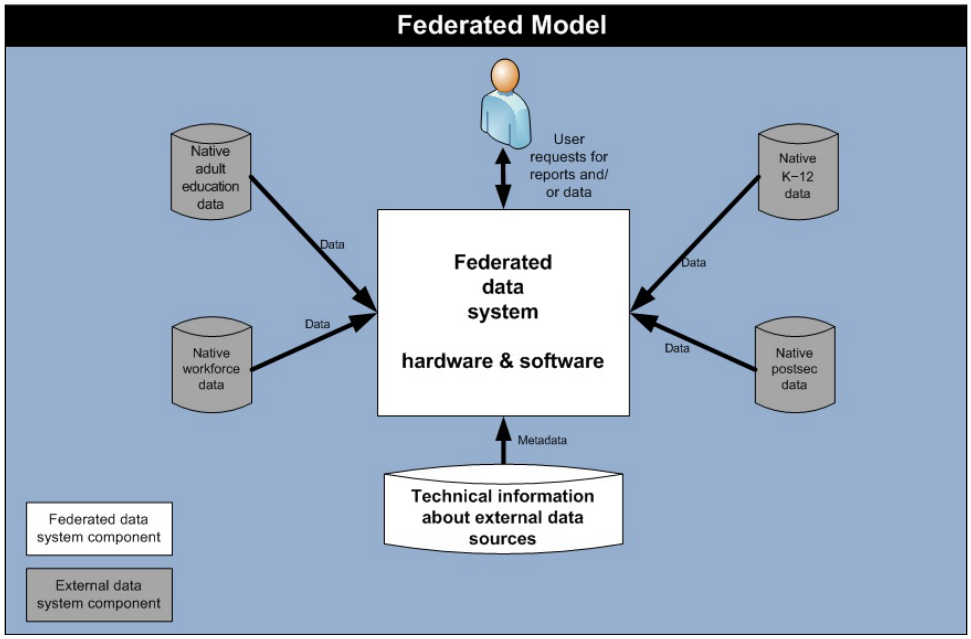


Exhibit 2-3 shows how independent systems can be connected with specialized software in a federated system.

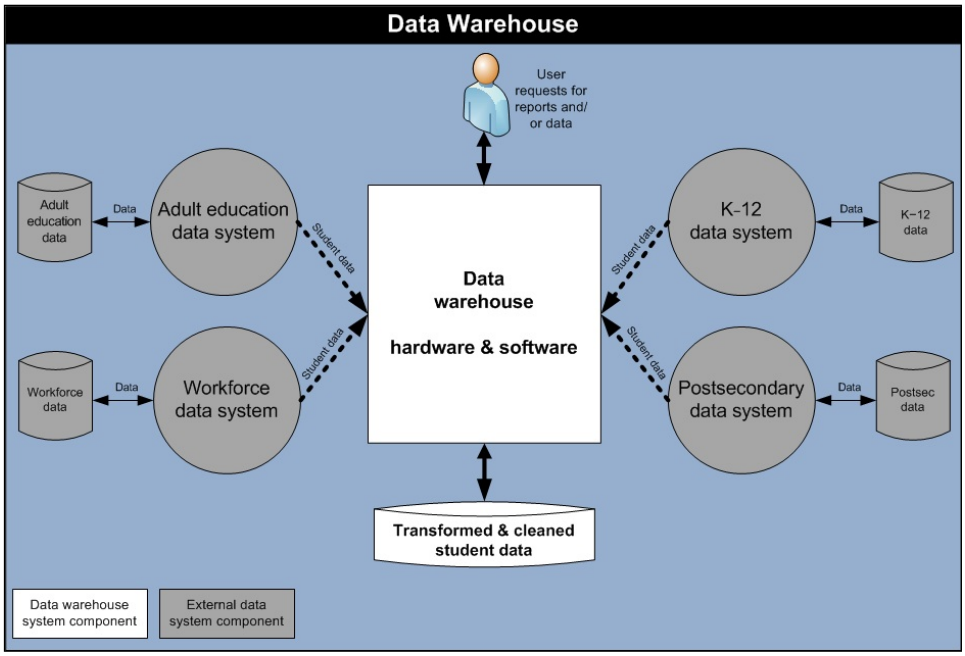
Data Warehouse Model

The data warehouse model offers a dedicated student records repository for data contributed by all participating organizations. Stakeholders maintain their own data systems for everyday operations even as they submit data that is replicated, cleaned, and transformed to meet the warehouse's goals. As a result, data in a warehouse tends to be of higher quality than data in a linked or federated data system. However, data replication, validation, and transformation take

time. Therefore, there is usually a lag between when live student records data are updated and when they are reflected in the warehouse database. Because data are replicated (copies of student records data are stored in the warehouse), care must be taken to protect student privacy and maintain adequate data security by data warehouse managers. As data warehouses operate separately from individual organization data systems, the warehouse model also requires its own tools and technologies, support staff time, training, and budget.

Participating organizations must commit to supporting the system by periodically providing their data. However, standardized data formats and data transfer methods make it easier to increase the number of participating organizations while increasing the range of valuable data available. In other words, the data warehouse system scales up well as more organizations are included. Exhibit 2-4 shows how independent systems share their student records in a data warehouse.

Exhibit 2-4. Data Warehouse Model



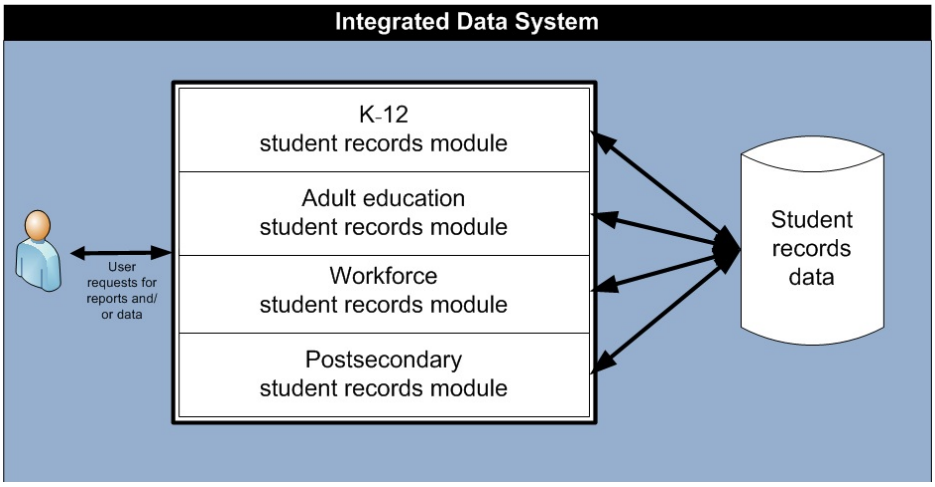
Integrated Data Systems

Integrated data systems function as a single unit for entering, reporting, and analyzing student records data in multiple education and workforce environments. While it can be awkward to integrate student records data of organizations having differing goals and approaches (e.g., K–12 and workforce), certain key issues, such as linking individual student identifiers, are addressed within the context of creating a student records data system used by all. Because the student records system doubles as an LDS for analysis and reporting, there is no need to bring together data from disparate systems; the data are already integrated.

Building an integrated LDS requires extensive cooperation from all stakeholders, as operational and reporting needs for all participating organizations must be considered. However, because modules for each educational entity are managed as a single entity, using the same technologies, data quality can be more easily managed. Assuming that needs of participating organizations can be addressed, an integrated system also enjoys economies of scale as efforts to develop and maintain the system are pooled. Because the challenge of accommodating operational and reporting needs grows with the number of participating organizations, this model

tends not to scale up as well as the data warehouse or federated models. Exhibit 2-5 shows how four different agencies might share an integrated data system.

Exhibit 2-5. Integrated Data Systems Model



Which System to Choose?

With at least four models available, your state must decide which one suits your LDS project best. LDS developers must assess their state's needs, available technologies, competencies, and funding to identify their most appropriate approach—or blend of approaches. The best selection depends on a number of key factors, including:

- **Number of agencies involved.** For example, the linked system works well with few agencies. Integrated systems may require substantial revisions as more agencies are added.
- **Resources and time available for system development.** Federated and data warehouse models are often more expensive to develop and maintain, while linked models are usually least expensive.
- **Technology infrastructure and expertise.** Integrated and federated models, for example, often require more technical expertise to develop, while linked models may be easier to put together quickly.
- **Quality of interagency relationships.** Integrated models require a high level of interagency cooperation, while the other model requires less collaboration and agreement.
- **Data Quality.** With linked and federated models, each agency must maintain its own data, and quality standards may vary. Data may not be timely in the warehouse model or in other models if records are not updated.
- **Reporting capabilities.** Linked models typically lack reporting tools; each agency must develop its own. Other systems offer common reporting tools.

Exhibit 2-6 summarizes the advantages and disadvantages of the models.

Exhibit 2-6. Advantages and Disadvantages of Longitudinal Data System Models

Model	Advantages	Disadvantages
Linked	• Supports both operational and analytical needs • Is less expensive than other options • Requires less time to implement • Is less complicated to implement	• Supports only modest data sharing goals • Has no reporting or analysis tools • Is difficult to sustain as the number of participating organizations grows
Federated	• Supports reporting and research needs • Is able to increase the number of participating organizations • Provides participating agencies additional control over management of their data	• Requires substantial planning and budget • Requires substantial technology, infrastructure, and expertise • Has a time lag between user query and data results • Data quality may be low
Data warehouse	• Supports mainly reporting/analysis needs • Is capable of reaching across agency boundaries • Allows for increase in the number of participating organizations • Has more reliable data quality	• Requires substantial planning • Requires substantial ongoing budget • Requires substantial technology infrastructure • Is not accessible for daily operating needs of teachers/case workers
Integrated	• Supports both operational and analytical needs • Uses economy of scale through combined resources across agencies • Provides real-time data use by teachers/case workers	• Requires investment in time and technology from all agencies • Requires high level of interagency cooperation • Is difficult to sustain as number of participating organizations grows; is challenging for newer agencies to join

Key Challenges

Beyond the inherent challenges that accompany any interagency system, states forming an LDS may face special challenges related to linking data across organizations. With differing service delivery models, nomenclature, methods for measuring outcomes, agency regulations, and available technologies, there are indeed bridges to build. Here are some key challenges for bringing together data from diverse systems into a cohesive LDS.

1. **Unique student identifiers.** To link student records across organizations, an LDS must be capable of matching student records originating in different data systems. Because different (and sometimes multiple) numbering schemes are often needed to identify students across data systems, LDS planners must determine how to connect disparate student databases into a cohesive whole. For example, some states might want to adopt unique statewide student identifiers for education (a long-term strategy), use an existing identifier (such as social security number), or implement another method.

2. **Common definitions**. Different education agencies often use their own terminology in reporting academic outcomes, attendance, and other student measures. To link or compare these data in a meaningful way, systems must use consistent definitions. An LDS may utilize a *metadatabase* to describe definitional differences, but planners must identify and determine how best to bridge them.[3]
3. **Consistent data formats.** To produce reports on students as they progress from K–12 to adult education, and on to postsecondary endeavors, an LDS must integrate data from a variety of sources. Because data in different systems may be coded or stored differently, some elements may need to be translated to a different format. For example, attendance hours tracked daily in one system might need to be aggregated for comparison with monthly attendance hours in another. Grade levels to track a student's progress in K–12 might need to be converted to an educational functioning level (EFL) for more consistent adult education reporting. Whether data are transformed into a common format or converted on the fly, the LDS needs consistent representations to provide cohesive comparisons.
4. **Data security and personal privacy.** With measures in place to address needs to ensure data security and student privacy (e.g., the Family Educational Rights and Privacy Act–FERPA), LDS participants must agree to handle data in a manner that is consistent with relevant usage and security policies across multiple agencies. In addition to interagency agreements, LDS tools and technologies must ensure that the system remains compliant with data security and student privacy. The Department of Education has established a Privacy Technical Assistance Center (PTAC) with resources that address privacy issues relevant to LDS development (see http://www2.ed.gov/policy/gen/guid/ptac/index.html).

The process for planning an LDS focuses on achieving an overall goal to facilitate data sharing and use across state organizations. Different from traditional organization-centric systems, LDS implementations must address issues of data sharing, integration, security, and access across organizations. LDS planners must understand the needs of key audiences and participating organizations to support development of a set of requirements and system architecture that addresses functional, operational, and organizational needs.

[3] To assist in resolving this problem, NCES has established Common Education Data Standards (CEDS) for the most commonly used education data elements for LDSs and to support the effective exchange of data within and across states (see https://ceds.ed.gov/).

Chapter 3. Where Is Adult Education? Getting and Staying Involved

With an understanding of what an LDS is and how it might be designed, we now consider the role that adult education plays in the design, development, implementation, and use of an LDS. Too often adult education is left out or overlooked, and this chapter offers guidance on getting and maintaining adult education's participation.

We will examine some of the contributions that adult education can make to a statewide system and the benefits that adult education can gain from being part of that system. Both concepts are central to building your relationships with other state agency staff and stakeholders. We will also consider communication strategies that may assist you in creating and maintaining these relationships to ensure adult education contributes to the development, implementation, and use of the LDS in your state. We conclude the chapter with a brief discussion of funding opportunities and other supports available for state LDS development.

Creating a Business Case

Adult education, through the NRS, has been at the forefront of using data not only for accountability purposes, but also for understanding programs and students in an effort to improve programs and enhance learning for adults. As a result, state adult education programs have much to offer their counterparts in the K–12, workforce, and community college systems with regard to understanding the value of data and how they might be used. In addition, adult education, as shown in Exhibit 1-3, often serves as the catchall for adults who drop out of K–12, look for entry to postsecondary, and require additional training for the workforce, as well as providing English-language skills to these learners.

This view of adult education should be part of a business case for integrating adult education into the state LDS in the first step prior to creating a communication plan. Adult education is often not considered for inclusion by other agencies. Many state agency and LDS collaborators may be scratching their heads, wondering why adult education wants or needs to be part of this system. Adult education does not have to answer to high-stakes testing, as does K–12, for example, and workforce agencies may see adult education as a training arm to support its aims, rather than an educational entity that fills the gaps for K–12 and postsecondary education. So, your first job is to show other agencies why partnering in the state LDS is valuable for the adult education agency.

What Is the Value of Adult Education to the State Longitudinal Data System?

The answer to this question will depend on the kinds of data the local adult education programs are collecting. The NRS-required data of employment, postsecondary entry, and secondary credential attainment, are important data that workforce, postsecondary, and K–12 agencies, respectively, will find of interest. However, offering a piece of data might not be enough to sell these agencies on collaboration with adult education.

Additional information that adult education programs may collect includes student data, such as demographics, program participation, test scores, completion rates, and age of entry. Family literacy programs may be able to share information, such as the number of adult students with children in the K–12 system. Programs often collect data on teachers, such as certification and

training background and amount and types of professional development obtained, and program information, such as types of courses offered, when, where, and at what times.

Consider additional data that your state or local program collects that may be of value to other state agencies and create a list of elements that spell out their value to other agencies. This will help you build your case to involve adult education in the state LDS collaboration.

What Is the Value of the State Longitudinal Data System for the Adult Education Agency?

Now let us consider why participation in the state LDS has value for adult education. Revisit the pipeline image (Exhibit 1-3) and the data implications of the flow of participants through education pathways into adult education.

- **K–12 education.** Adult education captures those students who drop out of K–12 and assists these young adults in obtaining a high school diploma or GED, and offers English-language learning, as well. Data for these students that would be useful to adult education includes test scores and information on untested students, level and type of coursework completed, and demographics of the students who typically drop out. These data can help adult education programs better prepare for these students by providing the missing coursework, focusing on the strengths and weaknesses of students, and understanding how many second-language learners may be coming from the K–12 system.
- **Postsecondary education.** Adult education programs would benefit from knowing whether adult learners are entering developmental education and other courses in postsecondary education, how well they are faring in these classes, and how many developmental courses are necessary, and in which topics. State adult education offices may wish to know how long it takes an adult learner to enter postsecondary education after completing adult education courses, and how long it takes these adult learners to get through college. Adult education programs may consider this information as they design their programs and courses to better meet the needs of adult learners in preparing for postsecondary education.
- **Workforce.** How many adult education students are entering the workforce, and what types of jobs are they getting? What salaries do students earn before and after taking adult education classes? Adult education programs could use this information to recruit new students and to collaborate with various industries that are in need of workers. Understanding the training and language skills needs of these workers or potential workers would benefit the adult education programs that serve them.

In addition, there is great value to the state LDS for reporting of NRS follow-up measures. A state LDS can identify students who have left adult education to enter postsecondary education and employment. Exhibit 3-1 summarizes the value of the state LDS to adult education, as well as the value of having adult education in the LDS.

Exhibit 3-1. Creating a Business Case for Adult Education in the State Longitudinal Data System

What is the value of adult education to the state LDS?		
For K–12	**For postsecondary**	**For workforce**
• **Data elements** – Demographics of adult education students at ages 16–18 and 19–24 – Number of students who obtain a secondary credential – Test scores for students who complete a GED or do not achieve this goal – Age of entry into GED preparation classes – Number of adult education students with children in K–12 system – Types of courses offered, when, and where	• **Data elements** – Postsecondary entry – Demographics of adult education students who enter postsecondary – Demographics of adult education students who set the goal of entering postsecondary but do not achieve the goal – Types of courses offered, when, and where – Student test scores	• **Data elements** – NRS data on employment – Secondary credential attainment – Types of courses offered, when, and where – Types of workforce training programs offered – Completion rates of adult education students
What is the value of the state LDS for the adult education agency?		
From K–12	**From postsecondary**	**From workforce**
• **Types of students** – Dropouts – ELLs	• **Types of students** – Developmental education course takers	• **Types of students** – Adult students in workforce or seeking employment – Adults in workforce training programs
• **Data elements** – Test scores – Untested students – Courses completed – Level of courses completed – Demographics	• **Data elements** – Number of developmental courses taken – Topics of developmental courses	• **Data elements** – Number of adult education students entering workforce – Types of jobs adult education students obtain – Change in salaries of adult education completers
• **Result** – Provides missing coursework – Focuses on student strengths and weaknesses – Estimates need for English-language learner (ELL) classes	• **Result** – Offers more courses or higher intensity in courses in which adult education students need to skip developmental education – Identifies goals for students based on the length of time between leaving adult education and entering postsecondary – Identifies goals for students on the basis of the length of time for adult education completer to complete postsecondary	• **Result** – Recruits students based on the industry type – Collaborates with industries according to worker needs – Creates courses that address skills and jargon of potential employers

In all of these examples, the value of data for adult education is coupled with the value of building relationships with other agencies. There are many more examples of data that adult education programs and state offices may find useful in understanding the needs of adult learners. Consider what value these agencies' data could have for your state and ask your local program directors what data would be valuable to them. Use this information to begin to build your business case for joining the state LDS collaboration.

Creating a Communication Plan

Now that you have built your case for the value of involving adult education in a statewide collaboration, how will you accomplish your goal of getting to the table of conversation? One way to do this is to create a communication plan that will:

- Identify your potential partners and other stakeholders or influencers
- Determine your objectives, depending on how far along the state is in development of an LDS
- Identify the information that will inform your message
- Select the person who can take the message forward
- Determine how to maintain the collaboration in the future

The following guidance can help you build your communication plan, but we do not recommend that you do this work alone. Find a core team of staff at the state office and among your strongest local program directors. Work together to build a communication plan that will get adult education into the state LDS collaboration.

Partners, Stakeholders, and Influencers

Whom will I partner with in my state LDS? Which stakeholders will advocate for adult education to join the LDS?

When developing your communication plan, consider the audience you want to address. For example, when approaching the state coordinator of the LDS, you will want to identify who the person is and what agency or system he or she resides in, who else is part of the collaboration, and who is not part of the collaboration but may be an influencer on the workings of the group. Some state LDSs are funded by the U.S. Department of Education and coordinated by K–12; others are funded through U.S. Department of Labor grants and coordinated by workforce agencies. (We identify some common funding sources and grants later in this chapter.) Often, community colleges or other university systems are at the table, as well. Some organizations and persons external to the collaboration may have influence. For example, in Texas, the state adult education agency was invited to join an initial conversation around the development of the LDS because a funder, the Joyce Foundation, insisted on including the agency. You may find that reaching out to staff at the Data Quality Campaign (DQC) or Data Quality Initiative (DQI) to voice your interest in participating in the LDS will create advocates for adult education in this development process.

Also consider engaging your local program directors, particularly those in politically important areas of the state. Sometimes your strongest advocates are stakeholders or influencers in the community that your local program staff knows well.

Determine Your Objectives

Next, consider your objectives for communicating with the state LDS collaborating agencies and other stakeholders. One objective, of course, is to join the collaboration. However, in some states, adult education directors are not able to directly participate in conversations at higher state agency levels, because of these directors' positions in the state bureaucratic organization. Thus, your objectives will depend on whom you are talking to and where you are talking from. If you cannot join the collaboration, your objective may be to influence the people representing adult education who are participants. You may wish to simply inform the state LDS developers of the data needs for adult education, or you may want specific data elements made accessible to you. Your goal may be to get immediate buy-in, or you may take the long view and see this opportunity to engage other agencies beyond developing the state LDS and to form relationships that will continue beyond this work. In any case, your objectives should include at a minimum (1) helping other agencies to understand your value and what value the state LDS has for adult education, and (2) building relationships with these agencies to further your mutual interests. Consider who your relationship builder is in the adult education office (or local program, if applicable), and we will discuss the value of this person on the next page.

Develop Your Message

Now that you have identified whom you will reach out to and your objectives for doing so, think back to the business case you developed above. The message you develop will integrate the information that you find to be important, including the value of collaboration for you and the other agencies. How will you frame your message? Identify the key message and supporting information. Use the data that you have collected on students both to make your case, and to show the value of the adult education program. Exhibit 3-2 offers an example.

What do I want to say to those potential partners? What information do my stakeholders need to ensure that adult education is engaged?

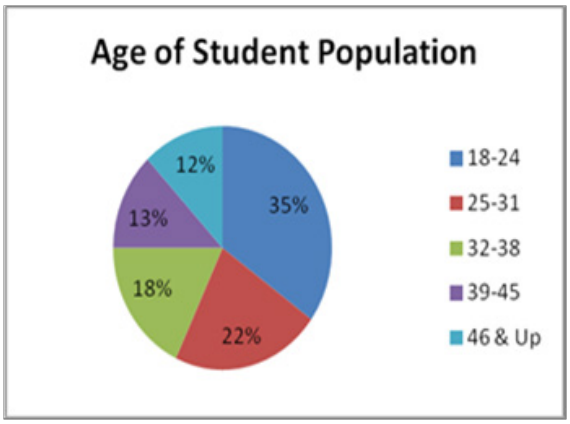
What data will help potential partners understand my adult education program? What message do I want to send?

In other words, if you join the collaboration—what's in it for you and what's in it for them? The mutual benefits of sharing information need to be spelled out clearly. Do not assume that other agencies know what your students look like, what their goals are, or how they transition after leaving K–12, before entering postsecondary, or within the workforce system. Your value-add includes providing information and awareness to other agencies while putting forth your requirements to ensure that adult education data needs are addressed.

Exhibit 3-2. Sample Message Supporting Adult Education

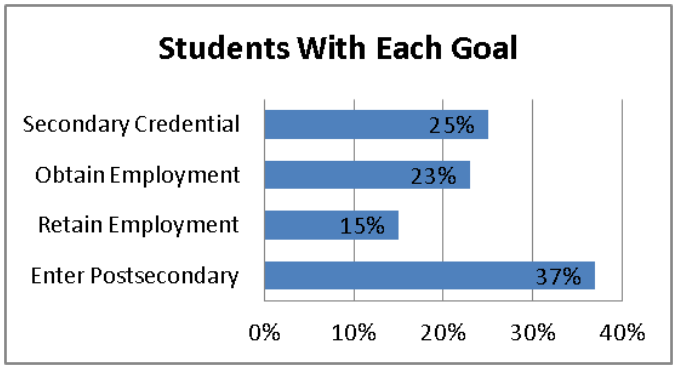
Key Message

Adult education in the state provides a significant amount of support to young adults who have dropped out of high school and need a GED.



Supporting Information

- Thirty-five percent of our learners are young adults between the ages of 18 and 24 years, and most of them come to the program within 1–2 years after dropping out of school. We can better assist these students to obtain a secondary credential if we can learn what level of courses they have completed and their test scores.
- Fifty-six percent of our students have a job and are looking to improve their skills, which they believe will lead them to better jobs and greater earnings. We would like to learn what occupations are in need of employees, and what kinds of skills employers are looking for. We can design our programs around the needs of state and local industry.
- Thirty-seven percent of our students set entering postsecondary as a goal. We need to know whether these students are entering college and at what level. By learning what courses these students are taking at entry, we can better prepare them to succeed in postsecondary education and to continue to graduation.



The Relationship Builder

Your adult education office may have that person who naturally reaches out to others and builds relationships and collaborations. Often this is the state director. However, in some states this is a deputy director or other state office staff member who has the ability to take the message forward. In some states, the director wears many hats and that places him or her in direct contact with other agencies. In some states, this same multipurpose role limits the time the state director has to spend developing relationships with other agencies. You know your state and office staff best. Determine who will be the relationship builder. Is it your state director? Is it your data system developer, who knows both the data system and adult education, who could best represent your needs? Is it possible to have more than one person from the state office engaged in the collaboration?

> *Who will be the relationship builder from your office? How many staff will participate in the collaboration?*

Regardless of whom you select as the point of contact to engage with the collaborating agencies, you will want to ensure that your state can support this person by providing data and information to communicate the needs and interests of the adult education program. Also,

consider what this person needs to foster communication. You may decide to develop a brochure or brief overview of the adult education program, using the information identified above in your business case. It is likely that, at some point, you will need to engage your database developer to ensure that the right data elements are captured in the statewide system, and that your adult education MIS can accommodate the requirements of the state LDS. Refer to the earlier section of this chapter on the development process and features of an LDS to familiarize yourself with these components and requirements.

Sustaining Your Collaboration

Even after you have initiated conversation with the statewide collaboration that develops the LDS and have arrived at the table, it frequently happens that goals of the collaboration focus on specific agency needs. For example, the coordinators may be focused on K–12 issues and defer adult education's participation until such a time as they are "ready" to address adult education. When this happens, it is not easy to get back to the table and back into the conversation. Sometimes decisions are made that work for some partners but not for all. You will want to plan for continued participation, and this may require some determination on your part. Go back to your objectives—you may need to repeatedly address the value of adult education to the LDS and vice versa. In addition, you may update your message and the supporting information to keep other partners abreast of changes in the population of students you serve. Also, respond to changes in your state and the way they affect these partners. If a recession or workforce shift is causing job loss in your state, be prepared to promote the adult education program and the way it is addressing this issue through skills training. If you have increasing rates of adult learners entering postsecondary education, share these data to help support the value of partnering to support these learners. Again, you know the context of your state best. Consider where you can be most useful to potential partners and how you can add value to the development of the state LDS.

How frequently will our staff meet with partners? What kinds of updates will we provide them to keep adult education in mind?

Funding Your State Longitudinal Data System

Developing a state LDS is a major commitment in time, energy, and resources. However, as discussed in Chapter 1, there are several federal and other sources of funding that can support LDS development efforts. We summarize these funding opportunities here and also present an overview of resources available to support state LDS development and operation, including interstate consortia. The consortia address not only development and operational issues but also sharing of data across states.

Who in my office will be the representative for adult education in the LDS conversations at the state level?

U.S. Department of Education Statewide Longitudinal Data System Grant Program

The goal of the U.S. Department of Education Statewide Longitudinal Data System (SLDS) Grant Program is to improve education decisionmaking through the availability of better data. The program is intended to support the design, development, implementation, and expansion of

K–12 and P–20W (early learning through the workforce) LDSs. The resulting data systems can then be used by states and other stakeholders to make informed decisions that will help improve student learning and outcomes.

The SLDS Grant Program was authorized by the Educational Technical Assistance Act of 2002, Title II of the statute that created the Institute of Education Sciences (IES), and has awarded competitive, cooperative agreement grants to states since 2005. These grants extend for 3 to 5 years for as much as $20 million per grantee. Grantees are obligated to submit annual reports and a final report on the development and implementation of their systems. All 50 states, five territories, and the District of Columbia are eligible to apply. In November of 2005, the first year of the grant program, IES awarded SLDS grants to 14 states (FY 2006 grantees). SLDS grants were awarded to 12 additional states and the District of Columbia in June 2007 (FY 2007 grantees), 27 states—including 15 new states—in March 2009 (FY 2009 grantees), and 20 states in May 2010, through the 2009 American Recovery and Reinvestment Act (ARRA). Another SLDS grant round was announced in September 2011.

In addition to the grants, the program offers many services and resources to assist education agencies with SLDS-related work. Best practices, lessons learned, and nonproprietary products/solutions developed by recipients of these grants and other states are disseminated to aid state and local education agencies. More information is available at http://nces.ed.gov/programs/slds/index.asp.

U.S. Department of Labor Workforce Data Quality Initiative

The goal of the Workforce Data Quality Initiative (WDQI) Grant Program is to fund state workforce agencies (SWAs) as they develop and use state LDSs. SWAs are expected to improve collaboration with other state programs so that one student's information can be tracked "across programs and over time" (Federal Register 2010, http://www.doleta.gov/grants/pdf/SGA-DFA-PY-09-10.pdf).

The WDQI Grant Program goes hand in hand with the U.S. Department of Education's SLDS Grant Program. The WDQI has the potential to create data that have been unavailable until now. For example, the database could potentially link information about individuals all over the country, using information such as K–12 records, adult education records, higher education records, wage records, information from Workforce Investment Act, Title I, programs, and trade programs.

The WDQI Grant Program was authorized through the Carl D. Perkins Career and Technical Education Improvement Act of 2006. This grant program awarded 13 states with funding in 2010. A new WDQI, FY 2012, grant was announced on February 21, 2012.

Other Federal Funding Opportunities

In addition to using the WDQI and SLDS grants, states can leverage other sources of federal funding for developing their LDSs. Many states have found ways to use Race to the Top funding to support their work connecting their separate data systems in order to improve reporting and the tracking of student information. Other sources of funding can be used to connect or enhance certain parts of an LDS. For example, the U.S. Department of Education makes funding available

through Title I grants to local education agencies that focus on early childhood or K–12. The Department of Labor also makes funding available through the Workforce Innovation Fund and the Workforce Investment Act for states that are working to streamline their employment and education outcomes and better report on core indicators. By using multiple sources of funding, states are able to include more agencies in the process, resulting in a more comprehensive, and thus more effective, LDS. The DQC website identifies many sources of funding to support state LDS development at http://www.dataqualitycampaign.org/build/fedfunding.

Foundations

Bill & Melinda Gates Foundation

The Bill & Melinda Gates Foundation announced awards for a total of $22 million to support states in their development of LDSs. A portion of that funding was distributed among multiple national organizations, including the DQC, the National School Boards Foundation, and the National Student Clearinghouse. In addition, some funding went to specific projects in the state of Texas. There have not been any additional funds awarded since 2009, but this may be a source of funding in the future.

The Michael & Susan Dell Foundation

The Michael & Susan Dell Foundation has funding available for Performance Driven Education. The foundation has awarded grants to the DQC and to the Texas Education Agency. These grants are not directly related to LDSs but instead focus on data quality and the use of data for improving student outcomes.

The Lumina Foundation

The Lumina Foundation, a private, independent foundation, was founded in August 2000. The foundation's main goal is to increase the number of students enrolling and graduating from college. This is currently the largest foundation exclusively dedicated to increasing student success in postsecondary education. The Lumina Foundation has also contributed funding to the DQC. Some Lumina grants are related to connecting secondary schools, community colleges, and workforce programs. Adult education could potentially serve as a link between these, and thus may be a category of programs that the Lumina Foundation may support. Up to this point, the Lumina Foundation has not provided funding specifically for data systems, but this foundation may be a resource in the future.

The Birth to Five Policy Alliance

The Birth to Five Policy Alliance was established in 2005 to support innovative policies aimed at helping young children at risk for low achievement. The alliance uses its funding to encourage a focus on increasing opportunities for young children; it funds the Center for the Study of Child Care Employment to integrate workforce data with child-level data, program data, and K–12 data. The alliance also works with states (e.g., Maine) to develop early childhood data systems. Although this funding source will likely not directly support adult education data systems alone, it may support larger scale longitudinal data development as long as early childhood data are included.

Supporting Your State Longitudinal Data System

There are many resources available to use in planning and implementing your state's LDS. These resources include a comprehensive range of supports, such as websites, publications, webinars, conferences, and even onsite technical assistance. The sources of support are also diverse, and they include the U.S. Department of Education, the DQC, nonprofit organizations, and other states that collaborate and share their own experiences. Below we describe the types of supports available from each of these sources.

U.S. Department of Education

In addition to offering funding, the U.S. Department of Education provides an extensive range of supports for states through its SLDS website (http://nces.ed.gov/programs/slds/resources.asp) and grant program. All states—whether they are grant recipients or not—may access the majority of supports provided through the SLDS website. The website offers a variety of resources that are designed to help education agencies develop an understanding of every aspect of developing a longitudinal data system, such as data governance and sharing, interoperability of systems, and making teacher–student linkages. Available resources include:

- **SLDS P–20W Best Practice Conference.** An annual SLDS P–20W (Pre-K to workforce) Best Practice Conference brings together representatives from states and territories to engage directly with their peers through sessions, small group discussions, and presentations. The agenda, panelists, and moderators are all determined by the states and State Support Team (SST) experts to ensure that discussions are relevant to the dynamic field of SLDS development and use.
- **Public Domain Clearinghouse (PDC).** The PDC, hosted by NCES on the "GRADS360°" website, provides a platform for states to share nonproprietary products developed for their SLDSs. This clearinghouse enables states to build on the work of others, thus conserving scarce staff resources, money, and time. States that share tools and documents on the PDC can also benefit from feedback and modifications contributed by other users. To gain access to GRADS360°—including the PDC—visit https://nces.grads360.org.
- **Assistance from the State Support Team (SST).** Both grantee and nongrantee states can request technical assistance on a specific SLDS issue as they strive to meet project objectives. A member of the SST is assigned to provide states with one-on-one mentorship through calls or visits. States have already requested and received technical assistance on many topics, including data governance, project management, and interagency data sharing. Support may be limited to a single engagement, but may be ongoing if necessary to help states overcome multiple or continued SLDS project issues. To request technical assistance from the SST, go to the GRADS360° website (https://nces.grads360.org) and select the "State Support Requests" tab.
- **Best practices briefs.** As part of the above ongoing interactions with states, SLDS program staff and SST members identify common issues and areas of need across multiple states. Technical experts then compile lessons learned and targeted strategies into best practices briefs that can be widely disseminated to states.
- **NCES National Forum on Education Statistics Publications.** The NCES Forum—a diverse group of representatives from state and local education agencies, the federal

government, and nongovernmental organizations—offers a host of free resources on issues that affect schools, districts, and state education agencies. The Forum is an excellent source of information on topics ranging from education data standards to practical implementation strategies (http://nces.ed.gov/forum/publications.asp). Of particular note is the publication series "Travelling Through Time: The Forum Guide to Longitudinal Data Systems," which is available for free through the website.

- **Topical working groups.** States collaborate in topical working groups to address common, ongoing topics of interest, such as interoperability between local education agencies, electronic transcript solutions, and P–20W data sharing. Three to six states meet regularly in these smaller communities to identify challenges, brainstorm solutions, and share best practices. Products from topical working groups can be shared to assist other states' SLDS work.
- **Monthly webinars.** Monthly webinar discussions provide venues for states to demonstrate products they have developed, share best practices, and discuss issues of interest. Recent webinars have averaged more than 50 attendees each and have covered topics ranging from data visualization to project and vendor management. Monthly webinars are open to staff from all state and local education agencies. These webinars are also archived and can be accessed at http://nces.ed.gov/Programs/SLDS/webinars.asp.
- **Listserv and e-mail correspondence.** An SLDS listserv is available as a resource for states and SLDS program staff. Via the listserv, states can quickly and easily elicit feedback on specific SLDS topics or challenges, share best practices, and discuss the possibility of further collaboration and assistance. The listserv is also used by IES/NCES staff to share important announcements and news.
- **Personnel Exchange Network.** The NCES Personnel Exchange Network (PEN) provides travel funds for state and district staff to visit other education agencies in order to gain and share knowledge and best practices about education data issues. Twenty states, from Hawaii to New Hampshire, have already participated in 20 exchanges, including 3 in 2011. Applications are available through the SLDS website, at http://nces.ed.gov/programs/slds/pen.asp.

Data Quality Campaign

As discussed in Chapter 1, the DQC is a foundation-funded national organization that encourages states to improve data availability and quality for the purpose of improving outcomes for students. The campaign specifically champions LDSs, and provides states with tools and resources to help with the development of such systems. In addition, the DQC encourages collaboration among organizations and departments to improve data quality, access, and use. The DQC provides support for LDS-building that includes

- **DQC's state analysis.** The DQC conducts an annual state analysis of state data systems that measures progress toward building and implementing the 10 essential elements of state LDSs and the 10 state actions to ensure effective data use.
- **DQC meetings.** The DQC provides a national forum for conversations about building and using longitudinal data systems. The campaign hosts regular meetings in Washington, DC, virtual webinars, regional meetings, and other assemblages to highlight critical issues

around data-driven decisionmaking in order to improve student achievement. These meetings are attended in person, as well as virtually, through a webcast.

- **DQC publications.** Each year the DQC releases numerous publications that highlight the power of longitudinal data to inform policy conversations, feature best practices in the field, capture state successes and challenges, and showcase promising strategies and examples of data use to improve student achievement.

More information on these supports can be found at http://www.dataqualitycampaign.org/.

Nonprofits and Other Organizations

Educational stakeholders and service providers, such as associations and nonprofits, also provide resources for state LDS development. A list of organizations supporting this type of work is available at http://www.dataqualitycampaign.org/about/partners/. Many of these organizations offer free publications on the topic of state LDSs.

State Collaborations and Consortia

Other states are a great source of highly relevant information and collaboration. The U.S. Department of Education's SLDS program has recognized the value of peer-to-peer support and includes states as a resource in many of its initiatives. In addition, states in some regions have developed formal or informal collaborations to align data systems and share data. Information on these partnerships, along with contact information for each region, is provided below. You may get in touch with the point of contact for any of these regions if your state is interested in joining or if you simply have questions about how to initiate collaboration in your own region.

The Midwest Education Information Consortium (MEIC) is a regional collaborative between Midwestern states (Minnesota, Nebraska, Iowa, Missouri, North Dakota, South Dakota, and Kansas). The group has been collaborating for the past 20 years. Primarily, the consortium has focused on the sharing of information between states for similar projects and on implementation of federal requirements. Members meet in person every other year and meet virtually on a more frequent basis. A recent initiative of a subgroup of states (Iowa, Kansas, Nebraska, and Missouri) involves developing a solution for tracking dropouts across state lines.

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The New England Secondary School Consortium (NESSC) is a regional collaborative of five New England States (Connecticut, New Hampshire, Maine, Rhode Island, and Vermont). The NESSC chiefs and legislative representatives serve on the council, which provides policy and direction. The SLDS directors in each member state serve on the NESSC Data Team, which meets six times per year. This group also includes researchers (the University of Maine's Maine Education Policy Research Institute, Brown University's Annenberg Institute, the University of

Massachusetts' Donahue Institute) and higher education representatives. The focus of the Data Team is on setting data standards and gathering metrics to support the goals of the council—for example, the development of shared college readiness and success metrics.

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Western Interstate Commission for Higher Education (WICHE), supported by the Bill & Melinda Gates Foundation, has embarked on a project entitled "Facilitating Development of a Multistate Longitudinal Data Exchange." Its principal objective is to pilot a data exchange among several states—initially four Western states (Washington, Oregon, Idaho, and Hawaii) have been invited to participate—allowing for more comprehensive analyses of the production, stock, and flow of human capital through a regional, multistate approach. During this 3-year, $1.5 million project, WICHE will coordinate efforts to develop the necessary architecture for the exchange of data, effectively govern the exchange, produce standard reports, and ensure the protection of privacy.

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Chapter 4. Implementing and Using State Longitudinal Data Systems: State Experiences

With the increased policy focus and after four rounds of funding through IES grants, 41 states and the District of Columbia have begun work to develop and formalize state LDSs. Regardless of their developmental stage, state LDSs' overall quality is improving and state leaders appear to be paying closer attention to the way data can be used to shape educational actions and instructional practice.

For example, in 2005, no state had all 10 of the elements that the Data Quality Campaign (DQC) identified as essential for a longitudinal data system. However, as of 2011, 36 states have all the essential DQC elements and all states had at least 5 of the 10 elements. Two states (Wyoming and Florida) incorporate all the 12 elements from the America COMPETES Act (see Chapter 1).

This section of the guide provides a close look at a sample of states that have implemented the state LDS models described in Chapter 2. These case studies provide insight into the development of the LDS models and the issues that states may need to address for implementation. We selected these states because their LDSs include adult education and their systems are in advanced stages of development or operation. We conclude the chapter with a discussion of the nontechnical elements that support LDS development.

Longitudinal Data System Models: State Implementation

Chapter 2 presents the following four models for implementing a state LDS:

1. **Linked data systems.** Each agency's separate data system is loosely linked through transfer and conversion formats that allow access by other agencies.
2. **Federated data systems.** Agencies maintain their separate data systems but electronically bring together data from individual agency databases, creating data to be shared across organizations.
3. **Data warehouse model.** Each agency contributes data to a single data source or "warehouse."
4. **Integrated data systems.** These systems integrate all data into a fully functioning, single system.

Of these four models, two involve linked but separate data systems (linked data systems and federated data systems) and two involve a single database system that houses all systemic data (data warehouse model and integrated data systems). As with any other interorganizational model, several essential developmental factors vary across organizations: cost, degree of interagency coordination, standardization necessary to implement, where the data reside, data maintenance, and accessibility.

We reviewed information on all states that have received IES SLDS grants to determine which include adult education and to gain an understanding of the development, operation, and current status of their systems. We summarize here the LDS stories for Virginia, Kentucky, North Dakota, Mississippi, and Indiana, states in which adult education has been involved in the design, development, and implementation of their state's LDS. For each state, we describe the

origin of the project, its development, current status and operation, including challenges or successes it has faced. We focus on states that are in more advanced stages of development and that have succeeded in integrating adult education into their LDS. While each state's experience is dependent on its unique context, the summaries present common themes and issues that may guide development efforts in other states. We include at least one state example of three of the LDS models: federated data systems; the data warehouse model, and integrated data systems. We found no state with a linked data system model that met our criteria for inclusion.

Federated Model

In a federated model, each agency maintains its own data but makes its data available for access by others through electronic linkages. Agencies that would like to access the data are required to request an account and establish a data use agreement. When data are needed to fulfill a user's reporting or analysis request, the federated data system software uses a standardized access method (e.g., web services) to obtain necessary data from wherever they are stored. The system uses data drawn from available sources, then generates a table, data file, or student record, and passes it along to the user.

Virginia's federated model

The Virginia Department of Education received a 2009 ARRA SLDS grant to broaden the reach of Virginia's existing K–12 and higher education data systems to include student–teacher linking, teacher licensure, "student growth" initiatives, e-transcript initiatives, and improved public reporting. At the heart of the 2009 grant program, however, was a "federated" research system, providing for multiagency data merging. This federated system was designed to comply with federal and state privacy requirements. Core partners involved in this project included Virginia Community College System, Virginia Employment Commission, Virginia Department of Education, Virginia Information Technologies Agency, State Council of Higher Education in Virginia, and the Center for Innovative Technology.

The federated system is a research system, and it is designed to be used periodically for data queries and not on a daily basis. Within the system, each agency and its data remain autonomous and requests for data are regulated by the individual agency regarding who has access to its data and what data is accessed. To obtain data from the system, a researcher, who must have a sponsoring agency, must submit a request for access to data. Only approved requests can be run through the system. In addition, every research question must be approved by the agencies that own the data that are needed. A designee at each agency whose data are going to be accessed reviews and approves or denies the request.

The outcome of this approval process is a data use agreement between the agencies and the researcher. With a data use agreement in place, the researcher then uses a "Lexicon" to formulate and submit a data query, after which the data from the various agencies are sent to the "shaker," where the data are matched on multiple values, using a probabilistic matching algorithm. The Lexicon also assists in interpreting the data.[4] The system then notifies the researcher of the

[4] This "interpretation" entails identifying what data in a particular column mean; for example, Column A contains names; Column C contains addresses; Column G contains test scores, etc. The researcher must still do some interpretation of the data to determine whether, e.g., enrollment in K–12's Math 101 is the same as enrollment in adult education's Math 5.

completion, and the researcher picks up the file containing the data that were requested. After the data have been analyzed and published, the researcher must destroy them. Each agency is given an opportunity to review the data before publication.

As this system in being put into place, Virginia is looking to expand in order to include additional agencies within the state and potentially to connect with agencies in other states, as well. To participate, agencies must provide a member for the SLDS governance committee and come to agreement regarding participation in the system. The governing policies and procedures that must be followed are documented in a "Book of Data Governance," which informs the members' actions. Potential members also have to create an infrastructure for their data that allows them to be compatible with other data.

As the SLDS is being developed, the Virginia Community College System, which oversees Virginia's workforce training–related programs, received a Workforce Data Quality Initiative (WDQI) grant from the Department of Labor in 2011 to design an LDS for workforce programs. The Labor Department WDQI involves using the federated system of the SLDS.

Adult education's participation

Virginia's adult education and literacy program, which is housed within the Virginia Department of Education, is a key partner in the WDQI grant project. Adult education is planned to be one of the first programs to test Virginia's federated SLDS. Adult education brings an extensive history of collecting and reporting data to the SLDS collaboration, including student-, teacher-, and class-level data, as well as outcomes such as enrollment in postsecondary institutions, achievement of high school credentials, and gaining or retaining employment.

Challenges

In creating its federated system, Virginia faced several procedural challenges, chief of which were student identifiers that were inconsistent across data sets and privacy issues around the use of personally identifiable information, including Social Security numbers. The state designed probabilistic matching routines based on name and demographic data that were to be used to match data across the data sets.[2] This "hash" algorithm is applied to relevant records based on a one-time "seed," which is then used to create a one-time identifier used to match across data sets. The one-time identifier is then stripped once the data are matched, thus preventing any personally identifiable information from being exposed when the results of the research is shared.

Data Warehouse Model

Education agencies in states that use the data warehouse model are required to forward all agency data, on a regular basis, to a centralized warehouse. There the data undergo a "cleaning" process to remove identifying information before it is analyzed in aggregate to determine both agency and state performance per variable. The warehouse serves as a gatekeeper and location for ensuring data quality. States' history in using this model reflects the intricacies involved at the state level in planning for this model's implementation and use, vis-à-vis using data to inform

[2] When a common unique identifier like the "State Testing Identifier" in Virginia, or a social security number, is available, it is used in linking data across data sets.

decisions and practice. Data warehouse models are a popular LDS model and we present three cases where this model is used—North Dakota, Kentucky, and Mississippi.

North Dakota's data warehousing model

North Dakota's Department of Public Instruction has spent several years working in collaboration with several state agencies toward a comprehensive system of accountability to ensure results-based decisionmaking and opportunities to improve student outcomes through data transparency and data analysis tools. The SLDS Committee was formed in 2007 after receipt of an IES grant and is responsible for governing a system for sharing longitudinal data with a goal of providing data to educators and policy makers to answer important questions about program and instructional effectiveness. Many agencies collaborate to design, develop, and implement the P–20 LDS: the Information Technology Department, Department of Public Instruction, North Dakota University System, Department of Commerce, Department of Career and Technical Education, Job Service , Education Technology Council, Department of Health, and Department of Human Services.

This interagency collaborative is charged with core tasks that include implementing a data warehouse incorporating metrics from Pre-K, K–12, postsecondary, and workforce; linking records according to standards for exchanging data; implementing a business intelligence system to develop and publish reports; and developing and implementing a data quality process. The SLDS maximizes the usefulness of management information, while protecting the privacy and security of personal information because, in compliance with state and federal laws, no personally identifiable data is made public.

The tasks for this effort are divided into two phases, with Phase 1 involving the broader scope of work. To date, several key activities have been accomplished, including providing data to the regional education associations and creating the ability to match workforce data with adult education and the career and technical education (CTE) data.

Phase II work will include expanding the data in the data warehouse (e.g., economic development, workforce analytics); incorporating additional Pre-K/early childhood data, considering other agencies' data that may be of value to the SLDS or to the agencies themselves; researching outcomes beyond accountability measures; and further training for stakeholders.

Through regular meetings, this collaborative helps to support the full development and implementation of a robust data warehousing model. Several core factors are crucial to the success of this collaborative approach to data warehousing management. For one, since several of the partners have different functions, communication among partners is crucial to ensure common understanding.

Each collaborative partner/agency has a memorandum of understanding (MOU) that identifies the data that agency will share; outlines each agency's responsibilities; and reiterates issues related to purposes, processes, and confidentiality. These MOUs are updated every 6 months, as necessary, allowing each agency to review its needs and obligations on a regular basis.

Adult education

As agreed on through the MOUs, all data are submitted to the state's Information Technology Department (ITD), which maintains the data warehouse and manages the collection of data from all pertinent state agencies. Adult education was viewed as a good program to start the LDS because of its relatively small number of participating students and the NRS data match requirements (postsecondary enrollments and enter/retain employment), which allowed for testing of the system on a small scale.

The state director of adult education serves on the executive committee for the LDS as the Department of Education's representative, and is positioned to ensure that the needs regarding adult education data collection, management, analysis, and reporting are met. This position ensures that North Dakota adult education plays a central role in the state's data warehousing initiative to raise awareness of adult education pedagogical and programmatic needs. In addition, this collaboration provides opportunities for greater understanding among partners, including partner goals and objectives that can be informed by relationships and data.

Adult education data are submitted to the warehouse and are analyzed and ready for retrieval on a quarterly basis through the ITD.

Successes

Now that the LDS has been implemented, the participating agencies are in the process of identifying effective ways for using the data and for promoting data use that can result in positive student outcomes based on the data.

The LDS development has been successful to date, due in large part to the factors summarized below:

- **Interagency partnerships.** Several agencies partner to support the development and meaningful implementation of the data warehousing model. With strong ties and MOUs among the key state education agencies, the data warehouse system serves not only as a bridge for connecting key state education providers but as a source for collecting and processing key historical information that can support students' upward mobility.
- **Interagency communication and sharing.** Each agency, through an MOU, agrees to share information that helps broaden the scope of the data and improve data quality.
- **Leadership-level representation from adult education.** The presence of a top adult education leader on the executive team ensures that adult education concerns are understood and addressed.

Kentucky data warehouse model

Kentucky maintains a state warehouse of data, which allows analyses of aggregated data for each participating provider agency. With an award of the state's first NCES grant during 2005–2009, the state established an LDS system called the Kentucky Instructional Data System. More recently (2009–2012), with another NCES grant geared toward expanding the state's system to include links to data from several state education sources (e.g., preschool, P–12, educator preparation and certification programs, career and technical education, postsecondary and adult

education, workforce, and other sources), the state has been positioned to promote collaborations between several state agencies for the benefit of students of all ages.

Driving Kentucky's data warehouse efforts is a collaborative group of core state-level partners, which includes the Council on Postsecondary Education, Education Professional Standards Board, Kentucky Higher Education Assistance Authority, Adult Education Department, and Department for Workforce Investment. This group meets regularly to discuss data needs relative to the development of the warehouse. What is unique about this collaborative is that it is administratively linked to the governor's cabinet for education and workforce, and the state's secretary of education chairs the collaborative, which gives the issue of data collection and management some prominence in the state. Kentucky also has a Workforce Data Quality Initiative (WQDI) grant, providing the data system with the capacity to link education and employment data.

Adult education

It was initially feared that including the state's adult education program in the LDS collaborative partnership would be difficult. However, after development had begun the program's inclusion was considered to be "easy" because adult education already had a "good" data system because of NRS requirements. Adult education in Kentucky is also involved in other state collaborative initiatives and steering committees; its involvement in the state's data warehousing effort offers valuable opportunities to examine the necessity of an effective data management system for promoting student achievement.

Challenges

Despite its strong support among partnering agencies, efforts to use the system and sustain the model are not without challenges. For example, the data warehouse is designed to examine trends using aggregate data. There is limited ability to look at individual student data. This is perhaps a key area for consideration in the full development of the data warehouse system, since the ultimate goal is individual student achievement across multiple programs.

In addition, Kentucky's NCES grant ended in February 2012 before it was completed, and the state has applied for additional funding. Efforts to obtain funding to support the continued development of the state's data warehouse are underway by raising legislative awareness of the importance of using data to drive instruction and policy. Furthermore, several state agencies involved in the development and implementation of the LDS system continue to meet regularly to discuss issues related to the effective implementation of the system.

Mississippi's data warehouse model

Mississippi began work on the conceptual framework for its SLDS in 2007 at the request of the governor. Led by the National Strategic Planning & Analysis Research Center (nSPARC), at Mississippi State University, the development of the framework involved much discussion among agency partners to determine what it should look like and how it could help improve educational outcomes across the board. The community colleges were the first to implement the warehouse system to track their students (credit as well as noncredit workforce trainees) into the workforce to measure placement and wage gains.

In 2009 the state applied for an ARRA grant to improve and expand the system. The award of this grant has provided the impetus for policy changes to occur and MOUs to be developed with the Mississippi Department of Education and other partners necessary to ensure a fully integrated and longitudinal system. These partners include eight state institutions of higher learning, Mississippi Department of Employment Security, Mississippi Department of Human Services, Mississippi Department of Rehabilitation Services, and Mississippi Department of Corrections.

Mississippi's data warehousing model links data using three overarching categories (or entities): individuals, organizations, and programs. For example, an individual could be a student or trainee, an organization could be an educational institution or place of employment, and a program could be K-12 enrollment or workforce course/training. All the linking in Mississippi is done through personal identification numbers, which are generated using Social Security numbers. When Social Security numbers are unavailable, personal identification numbers can be created by using a combination of other personally identifiable data, such as birth date, race/ethnicity, gender, and age.

All SLDS partners maintain their own databases; however, data from the various partners is sent to nSPARC to be de-identified (stripped of personally identifiable attributes and re-assigned a system identification number) and checked for validity and reliability. Scrubbed and de-identified data are then physically warehoused in the State's Office of Information Technology but are maintained and managed by nSPARC. Any longitudinal queries are designed and built around that warehoused data system, with linking achieved through the system-assigned identification numbers. Linking can occur in multiple directions.

Adult education

Mississippi has enjoyed a history of interagency cooperation and adult education was involved from early in the project. For the past several years, the Mississippi Community College Board, which runs adult education, has been contributing credit education, non-credit workforce training, and ABE/GED data to this system. Standard reporting has been developed for non-credit workforce training, with additional standard reports scheduled to be developed within the next year.

Successes

Mississippi was able to leverage several factors to overcome potential challenges and develop a successful system.

- **Shared history.** Mississippi has a long history of close collaboration between the partners involved in the IES grant. Because agencies were already used to working together, collaboration around the LDS did not require much convincing.
- **Clear communication.** Well-constructed MOUs ensured that each agency was aware of its responsibilities. Open lines of communication between partners helped to address any issue that came up that was specifically outlined in the MOUs.
- **An established framework.** The state had the added critical benefit of having already developed a framework for the system and having already used it to make data-driven decisions with regards to their community college workforce training. Thus, they had real

world examples of stories the community colleges were using (placement, retention, wage gains, etc.) to market their institutions and programs to policy makers. This made it fairly easy to convince others of the potential benefits of such a system.

Integrated Data System Model

Integrated data systems function as a single unit for entering, reporting, and analyzing student records data in multiple education environments. Building an integrated LDS requires extensive cooperation from all stakeholders, as operational and reporting needs for all participating organizations must be considered. When successful, however, integrated systems offer cost savings due to economies of scale. As the number of participating organizations grows, it can be challenging to create a system that meets the needs of all. Therefore, this model works best for linking data across a small number of participating organizations. Indiana offers an instructive case study.

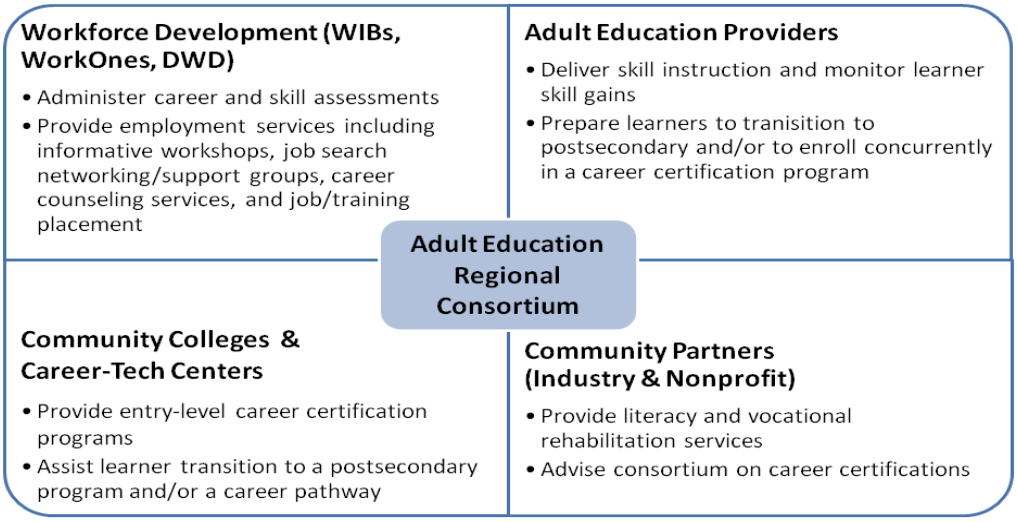
Indiana's integrated data system model

A grant from the Joyce Foundation "Shifting Gears Initiative" in 2006 provided the impetus for the Indiana's Department of Workforce Development (DWD) to collaborate with other partners—including the Indiana University Research Center, Indiana Department of Education (DOE), Indiana Chamber of Commerce, Commission for Higher Education, and Ivy Tech Community College—to create a state LDS, Indiana's Workforce Intelligence System (IWIS). IWIS links wage and employment data with education data collected by various partner agencies. A separate system, the DWD education data system (INTERS) was originally developed to support collection of performance indicators for the Carl D. Perkins Career and Technical Education Improvement Act of 2006 and assist with program improvement by linking CTE and other education data from K–12 and postsecondary institutions. Beginning in 2009, the Indiana DOE and DWD began collaborating on efforts to align adult education, workforce training, and employment. These conversations included still other stakeholder partners, including Ivy Tech Community College, the Indiana Chamber of Commerce, the Commission for Higher Education, and Vincennes University.

One critical shift that occurred during this time was the establishment of regional consortia throughout the state. These 11 consortia align with DWD's 11 economic growth regions, through which workforce services are provided. This alignment ensures that learners are able to get all their needs met within a single region. The adult education regional consortia provides a centralized means for the workforce development agencies, adult education providers, community colleges and career-tech centers, and community partners to plan collaboratively how they will spend their money and efforts. The consortium meetings also provide an opportunity for consortium participants to share best practices in order to improve their service delivery. Exhibit 4-1 outlines the responsibilities of each partner.

After the consortia around the state were awarded funding to begin offering services in 2010, implementation began. With the formal eligible agency status change in 2011, DWD continues to build on these partnerships and carry out the vision with a "many hands approach."

Exhibit 4-1. Indiana's Adult Education Regional Consortia



To enter data into the system, CTE and Adult Education providers submit directly to a centrally located database via a thin client application installed locally or accessed via an online portal. The server receives post-secondary, DOE and proprietary data as well as GED scores, TABE scores, and employment data (including wage and placement) from separate systems on a nightly basis, incorporating them into the LDS. The process appears seamless to the user as the most recent data becomes available every morning.

Data matching capabilities include use of social security numbers and/or Indiana Student Testing Numbers (STN), as available. For instance, STNs are required for K-12 students and are collected for all postsecondary students with an Indiana origin within the last decade. Adults who graduated from the K-12 system can easily be tracked because their student testing number follows them into postsecondary education. For client records that do not contain a Social Security number or STN, DWD runs an algorithm using an individual's name and address among other data points to conduct a data match.

Adult education

In 2011, the Indiana General Assembly moved adult education responsibilities from DOE to DWD, and INTERS was adapted to collect NRS performance metrics for alignment with WIA Title II responsibilities. INTERS and IWIS together link K–12 and postsecondary student enrollment in education, graduation records, employment, wage records, Unemployment Insurance benefit claims records, claimant demographics, WIA participant data, and Wagner-Peyser Act program data and adult education records. These data points come primarily from DWD, secondary schools, adult education, and Ivy Tech community college.

A new adult education state director played a critical role in helping to integrate adult education into the existing system. She was determined to get adult education involved and persisted until she achieved this goal. Her efforts were facilitated by the support of the senior deputy commissioner, who understood the importance of bringing everyone together and had the vision to see that the integrated data system serves the needs of both the adult education agency

and those of state partners. The state director has also relied heavily on other state adult education staff, which helped her to clearly articulate the benefits of data sharing.

Successes

Indiana attributes its success at LDS development to two factors:

- **Easy accessibility of data**. Because it is an integrated system, DWD has access to most agencies' data and has established data sharing agreements with the Department of Education, Commissioner for Higher Education, Professional Licensing Agency, and other assessment vendors for access to data that has not been integrated into the system.
- **Clear communication**. Through the process of building the system and setting up the agreements, the state has created a firmly established system of open communication, which makes it easier to address immediately any data issues that arise.

Summary: Elements Supporting Longitudinal Data System Development

The discussion above presents state activities that support the development of LDSs, including the ways states leverage resources and agencies collaborate. In the state examples presented here, the engagement of a variety of stakeholders in the development process was essential. Because an LDS will have many different users and types of data, this engagement helps ensure the system's usefulness and adoption. Multiple stakeholders can provide feedback on data needs and system design by identifying key questions that the system should address.

State experiences also reveal the importance of ongoing communication between the various agencies and groups involved in the state LDS. In the case studies, it is clear that open communication among state partners allowed for opportunities to share ideas and concerns and to address those issues in a timely, collaborative manner. Ongoing communication through regular meetings and decision points is also critical for dealing with any unexpected complications that may arise.

The presence of a broad vision and the emphasis on common goals also are also critical elements in LDS development. Although the technical changes that need to be made to develop a state LDS are substantial, the project is far more than simply an information technology project. Equally important are the conversations that must be had and decisions that must be made around:

- Who will be involved? Who is responsible for each piece?
- What needs to be done? What will the system look like?
- When does each step need to be completed?
- Where will the system be housed?
- How will all the pieces work together?
- Why are we doing this? What is the common goal?

Resolving the technical issues of the system does not suffice if these (and other related) questions have not been answered. Through a broad vision, the project can develop common goals that transcend the individual agendas of participating agencies. All partners have to see that they have a stake in the system and work toward a common purpose.

Below we summarize other elements of successful LDS development found to be effective by our states or are recommended by NCES.[5]

- **Develop a process and structure for data governance to maintain data quality.** Clearly defined roles within the governance structure around data requirements and use help ensure that the data in the LDS are accurate and reliable. With quality data, stakeholders are more likely to use the LDS effectively.
- **Strong leadership.** LDS development benefits from a strong leader with authority who unites the team. Having a strong leader with authority who understands and shares the grand vision helps to resolve conflict when it arises and reminds stakeholders of the importance of working together.
- **Memorandum of understanding for data sharing.** A memorandum of understanding (MOU) for each agency in the state LDS ensures common agreement and minimizes misunderstandings. The MOU can specify which specific pieces of data the agency will share and how often the data will be updated, and can provide guidance on how that data can be used. State teams should review the MOU regularly to ensure that it remains current and relevant.
- **Identify "data champions"** to support the development of the LDS at both the instructional and policy levels. Data champions—enthusiastic, effective data users who support the LDS—will increase sustainability of the project and help locate sources of funding, build support among stakeholders, and grow the use of data throughout the state. Data champions can serve as LDS ambassadors for the use and value of the system.
- **Assess the needs of the agencies and the state.** Needs assessments represent the collection of feedback from stakeholders on technical requirements, organizational structure, and data governance. These assessments identify assets and plan system use to better inform the development of the LDS.
- **Create a plan for professional development and training.** Professional development ensures that the system that is developed will be implemented and used properly at each level. Professional development should not only teach users to input and access data effectively but train them to better analyze and interpret the results to improve programs.

As the LDS is planned and developed, the goal of using data to improve education should also guide decisions. Including input during the planning stages from end users of the LDS, and providing training in system use will ensure that the LDS will be used by stakeholders at all levels to improve the education system and outcomes for individual students.

[5] National Forum on Education Statistics. (2010). *Traveling through time: The forum guide to longitudinal data systems. Book Two of Four: Planning and developing an LDS.* (NFES 2010-805). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Chapter 5. Using Longitudinal Data To Empower Your Research

The driving force behind building high-quality data systems is the need for access to better information about student, program, and state performance. As discussed in Chapter 1, an LDS can address questions about individuals or groups of students, teachers, or classes, and questions about policies, programs, and strategies, while providing information about important trends in behaviors and actions over time. With this information:

- Program directors can understand students' performance better and manage students more effectively and efficiently.
- Teachers can tailor instruction to help students improve.
- Policy makers can evaluate which policy initiatives show the best evidence of increasing student achievement.

However, getting an LDS in place is only the first step in the process of effectively using data for these purposes. As we have explained in several other NRS guidebooks, using data requires a cultural shift within states and programs that includes training to understand the data, and time to focus on analyzing and reviewing data and resources, before the data use can occur on a meaningful level. The DQC has identified 10 actions to promote data use (see http://dataqualitycampaign.org/build/actions/) and reports annually on state progress. According to the most recent report, states are still struggling to get procedures in place to issue data effectively, and only a handful of states have implemented many of the recommended actions, listed below, in Exhibit 5-1. DQC also reports that 42 states do not require staff to have "data literacy" and 36 states have not identified critical questions to guide cross-agency data efforts.

Exhibit 5-1. 10 State Actions To Ensure Effective Data Use

State Actions	
Action 1	Link data systems (early learning, K–12, postsecondary education, workforce, social services, and other critical agencies)
Action 2	Create stable, sustained support for robust state longitudinal data systems
Action 3	Develop governance structures to guide data collection, sharing and use
Action 4	Build state data repositories (e.g., data warehouses) that integrate student, staff, financial and facility data
Action 5	Implement systems to provide timely access to information
Action 6	Create progress reports using individual student data to improve student performance
Action 7	Create reports using longitudinal statistics to guide systemwide improvement efforts
Action 8	Develop a P–20/workforce research agenda and collaborate with universities, researchers. and intermediary groups to explore the data for useful information
Action 9	Promote educator professional development and credentialing to ensure educators know how to access, analyze and use data appropriately
Action 10	Promote strategies to raise awareness of available data and ensure that all key stakeholders, including state policymakers, know how to access, analyze and use the information

Source: Data Quality Campaign, http://dataqualitycampaign.org/build/actions/

This is not surprising. Grant programs have supported developing systems, but relatively few resources are available for the professional development around the analytic and reporting

functions needed for using data. To assist in these efforts, this chapter provides examples that demonstrate how to use longitudinal data to help understand student performance, teacher effectiveness, and program policy. We also include an example of using longitudinal data to trace students' transition from adult education to employment. The chapter concludes the guide with a summary of the lessons learned from state experiences and next steps.

Using Longitudinal Data To Measure Growth Rate in Student Achievement

A defining feature of an LDS is that it tracks the same type of information on the same subjects at multiple points in time. For example, part of a longitudinal dataset could contain specific students and their standardized test scores in 5 successive years, as illustrated in Exhibit 5-2.

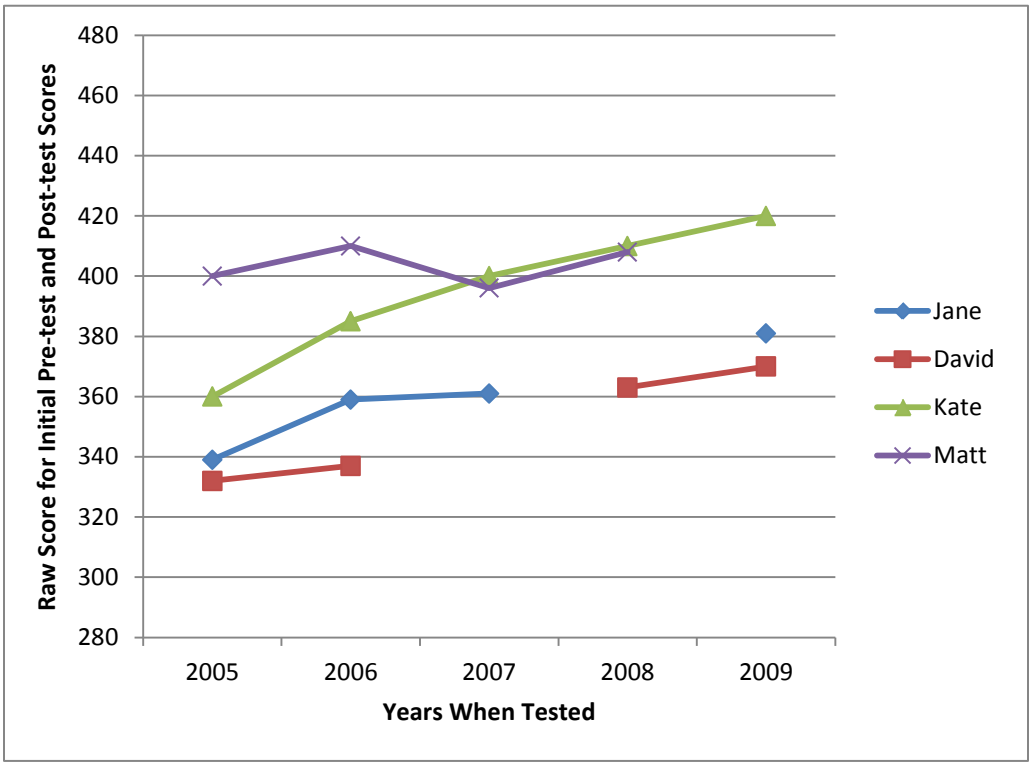
Exhibit 5-2. Sample Student Test Score Data

Student name	Initial (2005) raw score	2006 raw score	2007 raw score	2008 raw score	2009 raw score
Jane	339	359	361	-	381
David	332	337	-	363	370
Kate	360	385	400	410	420
Matt	400	410	396	408	-

Data from a state LDS allows us to measure change, so that we can estimate, for example, the rate of growth for individual students or groups of students, such as in a classroom taught by a given teacher, or in a program. With these analyses, we can tell how much students (or student groups) have improved on tests from one year to another. These analyses can also be used to compute growth projectiles that track student achievement across years.

Using the mock data above, Exhibit 5-3 illustrates growth with a graph that indicates the student test score projections over a 5-year span. This clearly indicates a positive trend, implying that the students have improved their performances over this time period. We can also calculate test score gains over time as percentages, to see in which year students made the most improvement. The availability of longitudinal data, which follow the performance of students, enables greater mining of information and makes it possible to generate an academic history for each student. Analyses can also include such indicators as the number of credit hours/attendance hours a student has taken, pre- and posttests scores for each level, and type of classes he or she has taken.

Exhibit 5-3. Sample Student Growth Chart



Teachers and administrators can employ this information to address questions such as

- **Academic performance monitoring.** Which students are on track/off track to pass an NRS level?
- **Diagnosis and prescription.** For students who are off track to pass the test, what are their difficulties? How can teaching methods be adjusted to address their difficulties?
- **Predictive analysis.** On the basis of previous years' data, can we identify early warning indicators that can predict which students are less likely to persist, or more likely fail?
- **Performance evaluation.** Can we evaluate teacher effectiveness on the basis of student academic growth over time? Can we evaluate program effectiveness on the basis of student academic growth over time?

Using Longitudinal Data To Examine the Effectiveness of Teachers

Just as we can examine students, with longitudinal data, we can use the change in student's achievement from one year to the next to estimate the overall effectiveness of individual teachers. This type of analysis allows us to examine the performance of successive classes of students by teacher and the extent to which teachers' effectiveness changes with experience or the composition of their classes.

For example, if we have data such as that shown in Exhibit 5-4, we can evaluate whether teacher A is more or less effective than teacher B by calculating the student test score gains (posttest minus pretest score). To test whether there is any relationship between teacher

characteristics and student achievement, we can use statistical models to calculate the effects of teacher characteristics (experience, gender, and age) on test score gains while controlling for student characteristics.

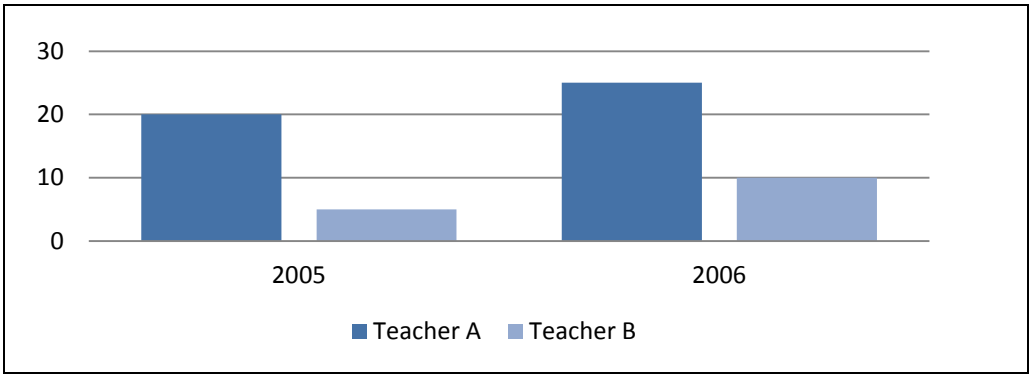
Exhibit 5-4. Sample Student–Teacher Test Score Data

Teacher ID	Student name	Test Score		Student Data				Teacher Data			
		Pretest	Posttest	Year	Gender	Age	Race	Year	Gender	Age	Experience
A	Jane	339	359	2005	Female	23	White	2005	Female	40	10
B	David	332	337	2005	Male	34	Black	2005	Female	40	10
A	Kate	360	385	2006	Female	23	White	2006	Male	30	2
B	Matt	400	410	2006	Male	34	Black	2006	Male	30	2

Teachers can use the information formatively to adjust instruction in real time, with a focus on individual student learning. Using teacher effectiveness information, programs have more leverage to motivate less effective teachers to attend professional development courses to improve their teaching skills. Program directors can also analyze data on the entire school to monitor progress and develop a school-wide vision and action plan with strategies that all teachers can adopt to address areas in need of improvement.

Administrators can also display such information graphically, as illustrated in Exhibit 5-5, where we plot student gains by teacher for 2 academic years. We can see that teacher A is more effective for both years in terms of improving student achievement. While this is a greatly simplified example, it demonstrates how states and program staff can use their LDSs to identify effective teachers.

Exhibit 5-5. Performance of Two Teachers' Classes Over 2 Years (Sample Data)



Using Longitudinal Data To Examine the Effects of Programs or Policy

Because longitudinal data extends over time, we can evaluate the effect of a specific policy by looking at relevant data before and after the policy was introduced. Longitudinal data also allow us to use sophisticated analytic strategies to measure the impact of various policies with reasonable precision. If the LDS includes the relevant variables, we could determine policy implications on measures such as student performance or teacher turnover.

For example, many states are currently implementing new teacher evaluation systems that require teacher value-added models that estimate the contribution of teachers toward improving test scores (calculated as student test score growth over time). Such models assume that the evaluation system will help teachers improve their performance by allowing them to know their value added in terms of student growth. To evaluate the effectiveness of this policy, administrators can use data from a state LDS to compare student test score gains before and after implementation of the policy, and analyze whether student gain—or teacher performance—changed after the state implemented the policy.

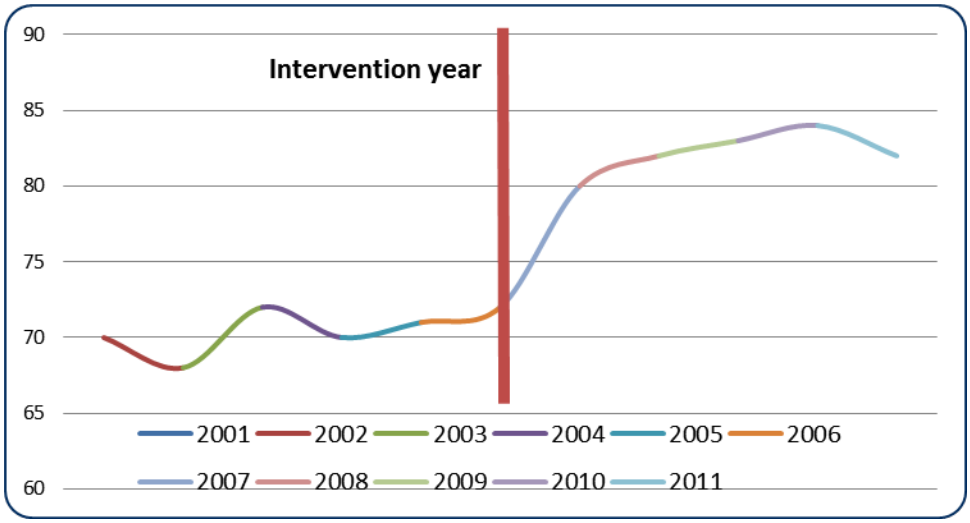
Another way that a state LDS can assist administration is by providing state directors with information to evaluate which programs to fund. Data on student progress can validate the need for funding for specific initiatives. For example, a state director may want to know the effectiveness of a new professional development program and whether it has affected students' performance since its implementation. Programs that provide high-quality professional development to teachers may see greater improvement in students' progress, and therefore funding toward a professional development program might be legitimate and necessary to guarantee a long-term improvement.

Using this example, Exhibit 5-6 shows a mock dataset of student test scores and teacher professional development participation in tabular and graphic form. Plotting student test scores against pre- and post-implementation of the new teacher professional development program, we observe a small jump in student test scores after the implementation of the program (Exhibit 5-7). Once again, this is an oversimplification, but it illustrates the potential of state LDSs to address critical research questions.

Exhibit 5-6. Examine the Effectiveness of a New Teacher Professional Development Program on Student Test Scores (Sample Data)

Year	Student test scores	Program
2001	72	Preintervention
2002	68	Preintervention
2003	72	Preintervention
2004	70	Preintervention
2005	71	Preintervention
2006	72	Preintervention
2007	80	Postintervention
2008	82	Postintervention
2009	83	Postintervention
2010	84	Postintervention
2011	82	Postintervention

Exhibit 5-7. Performance of Students Pre and Post the New Professional Development Program



Using Longitudinal Data To Examine Students Transition Into the Workforce and Postsecondary Education (Pathway Studies)

Another advantage of building a longitudinal data system is to follow students across programs. For instance, adult education programs enroll many high school dropouts, and if we can connect the K–12 education data system with the adult education system, we can assess students' prior performance and provide more individualized training to improve their academic performance. We also can examine whether adult education programs improve adult students' academic and employment outcomes if the LDS links educational data with workforce data.

With a hypothetical example, we illustrate how to use longitudinal data to conduct these pathway studies. In this example, we evaluate whether career counseling services provided by local adult education programs help students enter employment. To conduct this evaluation, we need to follow students after they exit adult education programs and compare employment of students who received the counseling services with those who did not.

Exhibit 5-8. Pre- and Postcareer Counseling Service Participation and Student Employment Status (Mock Data)

Status after exit	Control group (did not receive the service)	Treatment group (received the service)
2008		
Employed	33.33%	40%
Unemployed	66.67%	60%
2009		
Employed	16.67%	100%
Unemployed	83.33%	0

Exhibit 5-8 shows a mock analysis of 2 years of data on student participation in the career counseling program and employment status after exiting adult education. Comparing student employment status against the use of the counseling service, we find an increase in employment among students who used the service for both years. About a third of students who did not receive counseling in 2008 and about 17% of students who did not receive counseling in 2009 entered employment after exiting adult education. However, among students who got counseling, 40% who exited in 2008 and all who exited in 2009 entered employment.

Next Steps for State Longitudinal Data Systems

As we have discussed in this guide, all but a few states have begun developing or have a state LDS. However, creating a system is just the beginning. The future of state LDSs includes continued development and expansion to increase coverage, efficiency, and data use. Development of a state LDS is a work in progress, and there is great variation among the states in the current condition of the systems. In many states, adult education has not yet obtained a role of full partnership in the LDS efforts, although its eventual partnership within the larger LDS system is expected to be successful, given its current efforts in collecting, analyzing, and reporting NRS data. The next step for many states will be not only to integrate adult education within the wider LDS system but also to support collaboration that will help enhance understanding among key LDS partners, especially those who share the same goals and objectives.

One of the goals of this guide is to promote adult education's involvement by outlining funding opportunities, and describing how LDSs are developed and how agencies can use data. The next steps for your state will be determined, in part, by the current status of your state's data system. For example, states without an LDS should consider investigating which agencies and persons need to be involved in the development of an LDS and take the necessary steps to begin the development and grant application process. States with an established LDS, but without the active involvement of adult education, should consider forming important relationships with key adult education leaders who can contribute to the current system.

Promote Interagency Collaborations To Support Longitudinal Data Systems

Obtaining the active involvement of key state agents and agencies will require proactive communication from adult education state offices to ensure that those already in the LDS understand the benefit of including adult education. Importantly, adult education catches students that fall out of the K-12 system and prepares these learners for postsecondary education and the workforce. Adult education's role is vital to any state LDS.

Our review of the experiences in several states showed that state LDSs are most useful when there are multiple agencies and years of data. Interagency collaboration opens opportunities for knowledge sharing among agency partners and opportunities to keep the issue of data collection and data use invigorated. In addition, such collaboration presents the state with opportunities to strategically consider expanding data systems to support data-based decisionmaking and data use to inform practice. For example, the adult education system collects data on students who may also receive unemployment insurance—integrated reports that combine these data can help state agencies better understand the needs of these individuals. To make the best of opportunities for interagency collaboration, consider the agencies currently involved in your state LDS effort and

identify what types of data are missing. Then develop a plan to include other agencies that can help expand the nature and type of data in the current LDS system and help make the data more multidimensional.

Improve Opportunities for Data Use

The main purpose of an LDS is to maintain a multidimensional set of data on students over time in order to be able to recognize trends and relationships that can be used to shape pedagogic, programmatic, and policy decisions. Data from a state LDS can provide answers to research questions related to students, programs, and policy. Yet as data from the DQC has shown, only a handful of states have been able to use data effectively. Perhaps this is not surprising because efforts have, to date, focused primarily on getting the systems in place, with limited attention to using the data that the system provides. As state LDSs are implemented, states have an opportunity to use these rich data resources to answer questions.

The next phase of the LDS implementation will be the use of data to fully realize the vision of state collaboration.[6] The DQC's 10 action steps for data use and similar frameworks can guide these efforts (see Exhibit 5-1). In addition, adult education staff have initiated data use and research projects already—including recent NRS project supported efforts. Adult education can lead the way among their peers at the state level in understanding data analysis application of new information.

The research community can also be a valuable consumer of LDS data by conducting analyses beyond those needed for state accountability. Researchers can venture into understanding broader or more general topics, and can address complex questions that provide information on many different societal issues, such as return on investment and identification of successful program and instructional models.

Build Appropriate Infrastructures for Interstate Data Transfer

Because there is often so much interstate crossover, with students moving from one state to another to pursue academic or career opportunities, an emerging need is the ability to track students across state lines. With appropriate interstate data infrastructures, a state's ability to track a students' progress for purposes of state economic performance would not end when the student moves. The Western Interstate Commission for Higher Education (WICHE) described in Chapter 2 is an example of a consortium that supports LDS development and has developed frameworks for interstate collaboration to support these efforts. Increased interstate collaborations for data transfer will not only support data collection and use; it will generate conversations about the importance of LDSs, including the importance of enhancing the system so that it is beneficial to all states.

[6] For guidance on advanced system management and data use see National Forum on Education Statistics. (2010). *Traveling through time: The forum guide to longitudinal data systems. Book Three of Four: Effectively Managing LDS Data* and *Book Four of Four: Advanced LDS Usage.* (NFES 2010-805). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Conclusion

With the growing need to ensure that education actions are guided by solid data, LDSs can play a significant role in supporting a state's or agency's ability to make informed decisions. Although many states have fully developed LDS systems, others are still in the process, and a few have not yet begun. In addition, states vary in the type of LDS model they use, and often the blended approach they use depends on state-related factors. For example, although many states use a data warehouse model, the way in which they use it varies. While for one state, the focus may be on using a single agency to coordinate data input and output efforts (e.g., North Dakota), for another (e.g., Kentucky), the aim may be to establish strong legislative ties related to the data warehouse in order to promote stakeholder buy-in. Essentially, state needs and goals play a determining role in how states operationalize their LDSs.

The commonalities in state use of the data system reflect the way teams of stakeholders agree and collaborate in the process of the development and implementation of the LDS. Strong collaborations among state agencies within formal partnerships support the efficiency of the LDS. Through these partnerships, state agencies meet and communicate regularly regarding data input, output, and data infrastructure development. Adult education has already made great strides in developing a culture of data use for program improvement and state collaborations can benefit from learning about the adult education system while integrating adult education data into their LDSs. Adult education data is necessary for any state to have a comprehensive and multidimensional view of the education and workforce requirements of its citizens.