NRS Resource Guide to Data Systems

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Introduction

A good data management system helps to ensure data quality, offers easy access to data from the National Reporting System (NRS), and can produce reports that deliver useful insight into the needs of adult education students, teachers, and staff for data-driven decision making. By providing easy ways to enter information, a quality data system can make key recordkeeping tasks simpler, quicker, and more fun. From a federal perspective, the indicator of success for a data system is its ability to generate accurate and timely NRS data. Although most states derive these benefits from their data systems, some struggle to create systems that meet the needs of their staff, students, and federal funding agencies.

With almost a decade of experience since the NRS was adopted, states across the country have lived through the ups and downs of identifying requirements, the challenges of articulating their needs, the intricacies of dealing with vendors, and the intensity of grappling with organizational issues related to their data systems. To provide insight into the process of developing a data system, the NRS Support Project Team has evaluated the effectiveness of a cadre of systems. The team has heard from many states about the highs and the lows and has helped others to improve the quality of the data they produce.

This resource guide shares experiences from a sample of states that have offered their insights and experiences in implementing an NRS data system. This guide offers ideas and advice from states that have "found their way to a good place," in the words of New York's NRS coordinator, Rosemary Matt, one of the state-level participants who was interviewed for this project.

Although states of different sizes, population distributions, and ethnicities may find that they have different needs, this guide is intended for everyone who has faced the challenge of enticing programs to enter data in a timely way, assuring that their reports are accurate and that they have appropriate buy-in from stakeholders and so on. With peer-level information, this guide helps states to identify key challenges and provides insights to help plan an NRS data system.

Challenges, Solutions, and Lessons Learned

Developing a data system can be expensive. Although some states have gotten basic systems up and running for less than $100,000, others have spent $1 million or more. Aside from money, data systems also require substantial efforts and staff time at each stage of procurement. They also come fraught with common challenges in high-visibility projects—for example, maintaining quality and reliability, overcoming resistance of program staff, and dealing with institutional barriers and requirements—that may make the job more challenging. Despite the challenges, new systems offer an opportunity to build tools that:

- Facilitate the best ideas for improving outcomes and accountability

- Improve abilities to gather data that support decision making

- Address operational and logistical hurdles while saving money

- Move an organization to new and more reliable technology platforms

The NRS Support Project Team interviewed representatives from New York, Texas, Rhode Island, Utah, and Montana about their data systems, using an outline of common data system development steps. This outline provided a menu of topics to which interviewees could speak to frame our conversation and provided a way to prioritize the most vexing challenges and lessons learned. Based on responses, the team identified the following areas in which other states might share in the lessons learned:

Rationale	How to know it is time to develop a new NRS data system
Development Strategy	How to decide whether to buy a pre-made system, develop one from scratch, or take a blended approach
Vendor Selection	What to consider when selecting and dealing with vendors
Requirements	How to capture system requirements
Functionality	Understanding needed features and functions
Development	Dealing with the demands of the development process and possible challenges as the process proceeds
Data Conversion	Thoughts about the challenges of data conversion
Quality Assurance	Steps to test the system and quality assurance
Training and Technical Assistance	Ideas about training users of the data system and providing ongoing support
Managing Compliance	Insights about getting local programs to use their data system to provide accurate and timely data
Interagency Considerations	Institutional data sharing issues that may require time and attention

Rationale

Many considerations drive states to take the plunge to develop a new data system. Having a clear rationale about the system will help states make key technology decisions and build support for the project.

In recent years, many states have opted to upgrade their data systems. The decision to make improvements may stem from insurmountable limitations in their existing system, or advances in information and communications technology may enable states to implement new systems that provide more consistent data quality, access, system reliability, and compliance with state and federal reporting needs.

Understanding the rationale of peers may provide some insight about whether to make changes to an existing data system or develop a new one altogether. Below we summarize the reasons given by state staff in Texas, New York, Montana, Utah, and Rhode Island gave reasons for implementing their most recent data system.

Texas

State staff in Texas decided that it was time to address the ongoing challenge of importing data from local student records systems into their statewide database. Their practice of maintaining custom software to accept and reformat individual program data became very expensive, and data validation functions were not robust enough to ensure sufficiently high-quality data. The process of verifying data by hand and the high cost of repeatedly contacting programs to fix problems were significant factors in the decision.

Acquiring data was cumbersome and costly, and the former system offered only limited reporting capabilities. To support the state's efforts to manage its portfolio of programs, it needed a way to obtain reports from individual school districts. With better reporting, local programs could more effectively use the data system to make thoughtful programmatic decisions. A new statewide system also meant that local programs would no longer have to maintain their own data systems.

By building a new system, Texas could track the contributions of different funding sources to its programs and more easily generate funding source-specific reports. A new system would also support operational improvements and NRS reporting and provide many new and useful reports.

On the other side of the equation, the development process would require up to 13 developers and associated costs. To justify the efforts required to develop a new system, state-level staff prepared a cost analysis. With projections showing that the benefits of the new system would outweigh the costs, state decision makers went ahead with the project.

New York

Before its latest data system was developed, some programs in New York used a disparate array of data collection mechanisms. As a result, state staff could not easily compare statistics from its approximately 180 programs. Because data were not stored in a unified repository, even obtaining student-level data often required site visits. When submitting data in electronic form, program staff would, at times, inadvertently send the wrong version of their data files—an issue

that affected data quality. At the same time, large programs were asking for a system that their satellite sites could access. Having a unified Web-based system would address significant issues with data collection, management, and consistency and provide the state department of education and local program staff with access to data from student records 24 hours per day, 7 days a week. A single cohesive system would also greatly simplify the delivery of technical support to program staff.

Montana

Having extended the life of its old desktop data system by hosting it on state computers and enabling individuals to use it through a generic remote access solution (Citrix), Montana decided it was time for a change. Despite the state's efforts to improve access, the system did not fully meet program- and state-level needs or provide the range of reports needed to support program operations. A new Web-based system would provide additional control over the data and data collection process and help to save costs. Such a system would also maintain individual student records in a single place, helping to prevent double counting and over-assessing of students enrolled in multiple programs. With improved data validation, the system would ensure that student records are maintained accurately and in accordance with business rules in Montana and requirements from NRS.

Utah

Recognizing that its original spreadsheet-based approach did not adequately support its practice of funding programs based on outcomes, Utah identified needs to ensure data quality and consistency statewide. Although some state-level staff characterized some data from the former system as *pretty good*, Utah felt that a new cohesive statewide system would help to ensure greater accuracy and trust that the system worked well.

Rhode Island

Rhode Island's desire to implement a statewide data system came from the need for improved data quality. In the absence of a statewide system, programs would track student records independently without consistent standards and business rules. Some agencies used commercial products that allowed them to provide NRS data. Other agencies developed homegrown systems, and some maintained only paper records. Results were often difficult to validate because many agencies reported student outcomes and demographics in the aggregate. A well-developed statewide student records system would help to establish consistency and standards for data collection, maintenance, and validation.

Summary

The rationale for upgrading to a new data system is best driven by opportunities to improve data quality, mitigate operational costs, and deliver statewide capabilities that help to improve the experiences and outcomes of students.

By creating a system that offers student-level data in a consistent format, states have found it much easier to create tools that enable programs of all sizes and funding levels to leverage student data records as a decision-making tool.

By switching to unified and professionally managed systems, states have also availed themselves of opportunities to manage costs more effectively, thus avoiding the pitfalls of providing technical support for different sets of tools over which they have little control. For local programs, a unified state-level data system means fewer worries about technology and tools and more time to focus on the core mission.

Development Strategy

Approaches to developing a data system are governed by operational needs, available time, and organizational preferences. Some states opt for a build-it-yourself approach. Others buy a vendor-developed system, adopt one created by another state, or take a blended approach. Regardless of the approach, states can learn from the experiences of others who have been through the process. This section presents some insights from contributors to this guide from Texas, New York, Utah, Montana, and Rhode Island.

Texas

For Texas, the decision to build its own system was pretty easy. The complexity of maintaining student records in programs with different school, program, and fiscal years was not addressed by any off-the-shelf system. Similarly, an existing solution could not satisfy the reporting requirements from its panoply of funding sources or easily interoperate with a range of other state systems needed for data matching and followup. The extent of Texas-specific functions spoke eloquently for building a custom system.

When making its decision, Texas had substantial resources to make the development of a custom system viable. According to Sridevi Rangineni, who helped to manage the development of the Texas Educating Adults Management System (TEAMS), most applications within the Texas Education Agency are custom. "When you have in-house people, they had been in the agency for so many years and understand the needs well." Access to qualified developers is a compelling value when considering whether to buy or build.

New York

The promise of a system that was fully attuned to state- and program-level needs was compelling as New York made its decision to build a custom system. Built to specification, it would provide the exact portfolio of features and reports that state staff wanted for supporting its programmatic goals. The key challenge was obtaining the assistance of an experienced technology development provider who could do the job efficiently.

But unlike Texas, where technology development is a core capability, New York faced the additional challenge of identifying a vendor who had both programmatic understanding in adult education and the sophistication in technology development to create a system that was functionally complete, accurate, reliable, and scalable.

Utah

Like Texas and New York, Utah decided to build its own data system from scratch to meet NRS requirements. Utah also found it difficult to find an off-the-shelf system that could help program staff maintain student records consistently with the state's business rules. Utah wanted a system that could be used statewide and had the ability to track high school diplomas, credits, contact hours, and so on. An off-the-shelf product could not do that or be flexible enough to grow as new needs developed.

With in-house development capabilities already in place, Utah had the resources to do the job itself. Utah completed the job successfully by carefully managing four processes: requirements analysis, development, testing, and ongoing maintenance.

Montana

Montana decided to build its own system after reviewing vendor-developed offerings. Linda Gardner, Montana's information technology resource for adult education, characterized externally developed systems as "spendy" and felt that they wouldn't provide sufficient control over functionality. As a small state, with limited resources (e.g., spent less than $100,000 on the system), its team worked together closely to identify requirements and address particular technology challenges.

Rhode Island

Rhode Island's blended development approach was driven by the uniqueness of its adult education business rules and very short timelines. A contractor developed the core part of the system, and the state customized the system to meet the needs of its adult education program. This approach enabled Rhode Island to combine the benefits of *buying* with the flexibility of *building* to create a reliable and scalable system that is uniquely suited for the state. Rhode Island's Debbie Anthes explained the rationale for the approach:

> If developing the system in house, we would lose the expertise of vendors who know NRS business rules. In-house coders need training to understand NRS business rules. [For example,] off-the-shelf vendors already knew about changes in ethnicity code. When you bring [the system] in house, you have more flexibility as to timing, scheduling, and flexibility.

The buy-first-then-customize approach also enabled state staff to get a system up and running quickly and meet a state mandate to bring the development of information systems in house.

Summary

Functional needs, core capabilities, and available time can affect a state's decision to buy or build a data system. Although more complex needs call for more customized solutions, states with modest technology skills should think carefully about their abilities to follow through on developing a complex system. The success of projects in Texas and Utah were facilitated by strong in-house developers. Although ultimately successful, New York had to navigate some bumps in the road as it worked with an outside vendor that had strong NRS capabilities but fewer technology skills. Montana's solution was completed successfully through intensive interactions between a tight-knit team of developers and state staff. Rhode Island found success using a blended approach.

Vendor Selection

Apart from deciding whether to *buy* a system or *build* a custom one, states must also determine who will actually provide it. States that buy a solution typically work with an outside vendor but may also be able to adopt or modify a system used by another state. States that plan to develop a custom system may use in-house developers or a contractor. The vendor choice can be critical to the success of the project. When selecting a vendor, states should consider many factors.

Selection Factors

Each state is unique, having various technology development capabilities, operational needs, institutional requirements, scales, funding, and available solutions. Therefore, each state will likely have a different set of considerations when determining who best to provide a data system. A state's selection of a vendor will likely be based on several key factors, including the suitability of the solution, capability to deliver, extensibility (i.e., the ability to add or update features), and access to data.

Suitability of the Solution

A state's data system must provide necessary functionality to address NRS and state data management and reporting needs. But knowing how easily a system will operate before it is built is difficult to determine. To assess the suitability of a solution, states can look at descriptions and prototypes to get an idea about the thought and detail behind the system. Additionally, responses to Requests for Proposals (RFP) for custom systems should align clearly with expressed state requirements.

Capability to Deliver

Specifications and prototypes are of little value without an ability to operate as planned. Therefore, the states that developed successful systems tended to have good technical capabilities and good knowledge about NRS. When considering whether a vendor or an in-house system developer has the ability to deliver a quality system, three areas should be considered: level of experience with relevant technologies and tools, attention to detail, and evidence of

following a well-defined process when building a system. The right blend of capabilities will help to ensure that the end product is robust and reliable, matches state recordkeeping and reporting needs, and is relatively quick and easy to implement.

Extensibility

The solution and/or provider should have the ability to meet both current and future needs, especially as state or federal policies and practices change. Extensibility can be measured through the vendor's ability to make customizations or willingness to turn over the system to the state or another vendor if the need arises. If possible, states should gain from vendors just how extensible a system is to changes.

Access to Data

To provide the ability to analyze student or program records in new and useful ways, quality systems often provide access to data so that such data can be used outside the existing system. Direct data access, or an ability to export data, also facilitates the transfer of information to systems that may be developed in the future.

Practical Choices, Real World Decisions

Each of these vendor selection factors affected how states in this project selected a vendor, or whether they decided to work with internal staff. Each state considered whether proposed solutions would meet functional needs, whether the provider had the ability to deliver, the degree to which it would have access to the data for analysis and reporting, and other organizational factors.

Montana

Cost was a significant factor in Montana's decision to build an in-house system. With a sense that products from outside vendors would cost too much and that in-house developers might not be ideal candidates to maintain and modify a system that they did not build, Montana ruled out procuring a vendor-developed product. Despite a small budget, the state had the right combination of skills and sufficient determination to develop a system in 7 months for less than $100,000.

Texas

With robust system development capabilities and an institutional tendency to develop systems internally, Texas chose to build and customize an in-house data system. The state's technology staff had excellent Web development capabilities and the state-specific adult education knowledge necessary to create a system that meets the unique requirements of the state. With an in-house system, Texas would have a system that it fully controlled, making it easier to add reports and revise business rules in the future.

Utah

Like Texas, Utah had system development capabilities and a significant technology infrastructure in place. The budget and ongoing access to developers offered an opportunity to create a system uniquely suited to the state's policies and preferred data collection practices.

New York

Without internal system development staff available, New York looked for an outside vendor to develop a customized, Web-based data system. Looking at both pre-made and custom systems, the state hired the provider of its existing system to build the new one. This decision was based on the vendor's knowledge of state and federal adult education needs and successful past projects, despite somewhat less experience in building Web-based systems. Although the technical complexity of the project posed a number of challenges and took some time to complete, the state was happy with the results.

Rosemary Matt was responsible for content and data quality, and Venu Thelakkat represented the vendor's development team. They shared some key lessons learned from the process of procuring and developing a complex system across organizational lines:

- See the live system before buying it, rather than relying on prototypes
- Find a vendor who has the experience and probe for "what we have done," not "what we will do"
- Look for flexibility on the part of the vendor and the vendor's willingness to make - changes -
- Use a vendor who is willing to build reports that are customized
- Consider that not all vendors have systems that are NRS compliant
- Create absolutely clear specifications

Rhode Island

Rhode Island had to balance its interest in implementing state-specific functionality with an interest in getting a system running quickly. The state chose to procure a nearly ready-to-go vendor platform on which to build, which enabled the state to do the following:

- Tap the broad NRS expertise of a credible vendor
- Get a head start in developing the system
- Launch the system within 8 months
- Provide a way to implement a customized solution

To obtain this best-of-both-worlds solution (i.e., stability of an existing system plus the ability to customize), Rhode Island forged an agreement with its vendor to bring the system's *source code* and data in house. Through this approach, the state controls new functionality and development timelines, and the vendor focuses on its core business without having to engage in the detailed needs of a single customer.

Other states may want to consider Rhode Island's win–win approach. However, the approach has its own set of challenges. For example, how is such a deal negotiated with a vendor? What are the technical requirements for migrating the system and getting it to run on the state's equipment? How do states determine whether in-house staff will be able to update the system?

To pursue this approach, Johan Uvin, former Rhode Island state director, consulted a variety of experts to help in the procurement process. He reached out to consultants regarding the system's technical requirements and to an attorney about contractual complexities. He also worked with his director of information technology to provide input for the state's RFP.

> I [Dr. Uvin] made sure I had a good tech person and attorney to advise me. The RFP had lots of technical specifications. Attorneys enabled us to have access to the code. Otherwise, there was no way to know how to approach this.

Summary: Tips for Selecting a Vendor

Each of the five states that were interviewed for this resource guide had different needs, budgets, in-house capabilities, and solutions. Whether large or small, rural or urban, or adult basic education or English as a second language, their insights can guide others as they procure their own systems:

- Be clear about what should really be built.
- Both technical and NRS/adult education expertise are required to build a data system.
- Vet the vendor's qualifications as thoroughly as possible.
- Understand the limitations of the vendor's offerings and be sure you can work with them.

Requirements for Development

Requirements communicate the functionality, operating constraints, quality expectations, training needs, technology, and other elements that characterize a data system. When well conceived, they clarify the key parameters of the system for vendors and developers.

For state-level staff, the process of developing requirements offers an opportunity to think through specific needs, make priorities, explore tradeoffs, and consider the bounds of what is feasible. For prospective system users and other stakeholders, participation in the process offers

an opportunity to voice needs and concerns; such input can help to strengthen the end product. By contrast, ambiguity or absence of requirements can lead to long and troubled projects.

The interviews with state staff explored the process of developing requirements. Some states used more formal approaches than others. Some involved relatively large teams, decision makers, experts, and users. Others were more modest in nature. Each state shared their ideas about the process and lessons learned.

Montana

Montana's biggest challenge was writing effective and complete specifications to produce a system that would support state and federal business rules while speaking to the real-life needs of students. The state started by focusing on NRS guidelines and did a lot of "what iffing." State staff also professed their wish list for reporting, analysis, and student records functionality to local program directors.

Utah

To gather requirements for its UTOPIA system, state staff in Utah started by reviewing existing systems. Working backwards from NRS reports, they asked what business rules were involved in generating needed data. Through this process, state staff were able to hammer out technical details for the data system and clarify state assessment, attendance, and other policies.

Management hosted pizza parties to bring state staff together to discuss business rules collaboratively. Staff also reviewed operational scenarios as a way to validate policies for appropriateness and completeness. For example, the team considered what happens when a student is enrolled in more than one program at the same time.

In the end, Utah's state director noted the importance of getting the specifications down before coding the system. Doing otherwise increases the workload exponentially.

Texas

Texas spent a substantial amount of time developing its requirements and consulting many of its stakeholders along the way. Joanie Rathlake, Texas's state director emphasizes the importance of a collaborative approach by suggesting that "Releasing a new system is buy-in." To help identify requirements, the state hosted working group sessions that included both savvy and inexperienced system users.

The Requirements Development Committee spent a lot of time discussing NRS requirements and issues with the existing system. The committee reviewed screenshots for the new system and asked for input. The work was challenging because programs and practices in different educational settings required different types of data entry (e.g., distance education, classroom training).

Because developers attended meetings and took their own notes, they were able to develop a deep understanding beyond what was written in the requirements document. This helped them to make design decisions as the project moved into the development stage.

Rhode Island

To meet the challenge of getting the technical specifications right, Rhode Island reached out to a range of professionals with knowledge about the importance of the project. Augmenting their own expertise, state staff looked for input from the state department of education's information technology director, an independent technology consultant, and local program staff.

During the process of developing requirements, participants focused on the system from both a data use perspective and a program-level perspective. They asked what do we want students, teachers, public/stakeholders, and the state office to be able to do with the data in the system.

Summary

Developing requirements was a common challenge for staff in all of the states that were interviewed. For most states, working with the broadest possible range of stakeholders helped to shake out the requirements effectively and inclusively. The best sets of requirements covered a range of operating scenarios, whether drawn from a lot of *what iffing* among state staff in Montana, pizza parties with a purpose in Utah, or working group meetings in Texas and Rhode Island. Interestingly, states used requirements development activities to facilitate buy-in from the field, thus gaining a double benefit—requirements and support—for their efforts.

Functionality

With diverse programs, funding sources, technologies available, numbers of students, state requirements, and so on, the design and capabilities of NRS data systems vary from state to state. Nevertheless, data systems also have many similar elements, necessary features, and capabilities or *functionality*. For example, an NRS data system ideally provides a way to enter intake, assessment, and attendance data, and so on. Most importantly, all systems must be capable of delivering timely and accurate NRS tables. The better ones maintain student-level data to provide substantial flexibility for reporting, data validation, and operational support for local programs. This section explores the philosophies that guided states as they identified and made functionality decisions.

Approach to Functionality

In Montana, Linda Gardner took a basic view of what a data system should do, suggesting to "keep it simple" and not "get too fancy." Getting a system running quickly and cost effectively can be challenging. Therefore, NRS-related functionality should serve as a core upon which to build the system.

When looking at the functionality to include in its data system, Texas decided to look at the big picture. Because data used for NRS reporting are also valuable for desk monitoring and reviewing grant applications, Texas built its system with these functions in mind. With an interest in using data to inform curriculum and pilot program effectiveness, the state included additional information to support these needs. Because adult education in Texas is driven by diverse funding sources, the system had to track more than the basics.

Consistent with its blended approach, Rhode Island looked to the "keep it simple" philosophy as a starting point but recognized that the need for state-specific functionality would soon follow. Its choice of an off-the-shelf data system with opportunities to bring it in house supported this approach.

Data Quality Features

Regardless of functionality, features for maintaining data quality were top of mind among state staff that were interviewed. From Montana to New York, states wrestled to balance the requirement for robust data validation with needs to make their systems flexible enough to address common operating scenarios and be convenient for local staff to use easily.

Staff in Montana knew that people were gaming the old data system and recognized a need to "tighten down a lot." Nevertheless, some rules were too stringent. For example, Linda Gardner said, "NRS says use lowest test score, but what happens when the student wants to focus elsewhere (reading is lowest but student wants to focus on math)." Although quality data depends on clearly understood business rules and competent data checks, systems that are too rigid can inhibit data quality by making entry of student records cumbersome and inconvenient.

New York's Rosemary Matt echoed the call for robust data checking. She said that data checks should reflect both NRS business rules and state requirements. For example, New York's system checks that students are assessed within 36 contact hours following intake, a requirement for state reimbursement.

But ensuring data quality in New York is not just delegated to the system's data checks. The need for monitoring data quality and managing the data entry process, at least at a high level, requires management tools. For example, using system features that indicate who is regularly entering attendance and assessment data, state staff can remind lagging programs to enter their data and provide technical support where needed.

Recognizing the importance of data quality, Rhode Island, like other states, identified built-in data integrity checks as a beneficial part of its system. The system checks user entries for accuracy and consistency with adult education business rules. The system limits the entry of post-testing instruments, makes sure that entered dates are within reasonable ranges, and so on. The system also automatically calculates educational functioning level (EFL) from test scores,

thus eliminating the potential for programs to misinterpret potentially confusing assessment rules.

Rhode Island's data system includes an approvals function, thus meeting state requirements that data be reviewed after entry. Program-level reviewers use the approval function to confirm the accuracy of every entry into a student's record, including intake, assessment, attendance, and so on. Programs get credit only for educational gains that they have checked and approved. Unapproved data are not counted in NRS totals.

Workflow Functionality

Workflow functionality includes the order in which the system allows data to be entered (e.g., student must be enrolled before attendance is entered), the steps required to enter data, and the security permissions that allow particular staff members to enter data as needed. A system's ability to work within the framework of a program's workflow affects how easily it can be adopted.

Individual staff members in each local program have different responsibilities for entering student records data. Data are also entered in a particular sequence and at a particular time. For example, teachers in a program may be tasked with entering their own attendance information after each student has been enrolled.

Even within the same state, however, local programs may have somewhat different workflows. Although individual data systems have different models for managing workflow, states must consider how the data entry process will work and which parts should be flexible and identify the roles that program staff may play.

Texas's data system tries to follow a simple sequential workflow model for entering data. For example, Janell Baker, assistant state director, said, "If I don't have a goal, I cannot go any farther. Then we enter assessments, followed by class registration." By mirroring the workflow for managing a student's case, a system can make the job of data entry easier, which is a plus for program staff that are tasked with managing student records.

Because data entry roles tend to be different, data systems must be flexible enough regarding who has access to particular functions, features, and reports. Texas created 10–12 different roles (e.g., intake entry, attendance entry, etc.) that can be mixed and matched to meet the responsibilities of particular staff members. Some roles came from the existing system, and others were identified during requirements analysis for the new system.

Rhode Island aligned the workflow of its system with its student intake forms. This effort involved the data system itself and dovetailed with a separate effort to create a standardized form that could be used as the basis of statewide admissions procedures.

Reporting

A basic requirement for all data systems is that they generate a complete set of NRS tables. But to be truly useful as management and decision-making tools, data systems must go beyond the basics. To promote data use among local programs, a data system must have the ability to produce a wide range of reports that meet local needs. For example, to help program staff identify students who need posttesting, data systems can provide a report of students who meet the state's posttesting eligibility criteria. Furthermore, attendance reports may be used to identify students who have been missing class, and other reports may help with followup activities and so on.

The data system in Texas provides a variety of reports that focus on student demographics, goals, assessments, attendance, outcomes, and achievement. For staff working at the classroom, program, and state levels, reports can be run at class, site, program, and provider levels.

With a deep interest in data use, Rhode Island identified flexible reporting functionality as an important element of its data system. Diving deeper into data requires a large collection of reports and the flexibility to invent new ones. Rhode Island determined that off-the-shelf report writing tools would not be simple enough for state and local staff to use. Ultimately, the state chose to build a simple in-house tool to support data-driven decisions, thus providing a powerful tool for use in its data use learning community.

Rhode Island and other states are becoming increasingly interested in trends over time. With many states now building multiyear data systems, more states will likely add these types of reports to their data systems.

Innovative Functionality

With an eye toward ease of use and making student records data more insightful, some states are implementing innovative features in their data systems, for example:

- **Document Scanning.** To better manage documentation, Utah's UTOPIA system includes a scan button to capture images of birth certificates, transcripts, and other relevant documents for storage in its database.

- **Student Portfolios.** Rhode Island looks toward meeting the needs of nontraditional users of NRS data systems. For example, it provides students with opportunities to create their own portfolios.

Summary

Data systems can provide many different functions for managing and reporting on student records. Some core functions consistently appear in some form in every NRS-compliant data system. Other features are vital to meet state-level needs, and others offer helpful but maybe not critical capabilities. This section explored functions of interest that were identified by states

in this guide. Performing a careful analysis of requirements will help states to identify a full complement of functions and features that are most appropriate for their specific situations.

Development

During the development process, a vendor or in-house staff creates software to deliver a system's functions. Programmers develop computer instructions to manage workflow, administrative functions, system security, and more. A successful development process will deliver a robust, reliable, maintainable, and extensible system.

Equipped with optimism and a good requirements document, states that have chosen to build their own custom data system next move into the development phase. Unfortunately, history is littered with projects that fail in the development phase. Sometimes development failures result from poor planning. Other times, system developers do not have the proper skills or systems fail from lack of testing. The use of unsuitable equipment can also sink a project. A methodical system development process can help to mitigate some of the risks.

During conversations about the challenges of developing a custom data system, Sridevi Rangineni, Texas's systems analyst, outlined the state's process for producing a data system:

- Requirements gathering

- Requirements review and approval by state director

- Database design

- Development of use cases

- Development of application

- In-house testing

- Beta testing by state and program staff

- Training

- User acceptance testing

The process identifies key tasks that are designed to produce systems with high standards of functionality, reliability, and security. Because launching data systems requires training, data conversion, and attention to quality assurance, a well-defined process helps to ensure that no important task goes undone.

A full discussion of the development process is beyond the scope of this resource guide, but the outline from Texas offers some insight into the number of steps and precision required to develop a quality data system.

Despite a sense of exhilaration at the completion of a challenging project, the development process usually represents the end of a phase but not the end of the work on the data system. Utah's Marty Kelly emphasized this point by noting the completion of the state's ongoing nonstatic system. Although the completed system included 80–90% of functionality, data systems in Utah and other states continue to be works in progress. System development is an ongoing activity: users always want more, and bugs always have to be fixed.

Data Conversion

After the data system is developed, states must prepare for its launch. One important pre-launch activity involves moving historical data into the new system. This process can be simple but often requires a substantial amount of work, including restructuring data from multiple sources and quality assurance activities, and does not go exactly as planned.

For example, Rhode Island's pre-launch data conversion plans for some of its local programs turned out to be unfeasible. A contractor had to be hired to manually key existing data into the new system. In New York, some programs had trouble moving their data from proprietary local databases into the statewide system. In some cases, differing data formats made it difficult to determine how information from the old system could be best converted for use in the new system. In other cases, programs had to export and send current student records data on disks or CDs, rather than simply transmitting them electronically for use in the new system. New York's size and diverse types of programs made the challenge even greater.

Conducting an early analysis of steps required to convert all sources of data will help states to identify issues that may delay, or even prevent, a successful data conversion.

Quality Assurance

Testing is a vital part of the development and pre-launch processes for data systems. Testing enables system developers to check the quality of their work, users an opportunity to try out the software using realistic operating scenarios, and state staff to make sure the system operates consistently within requirements. To achieve these varied goals, data systems commonly go through as many as four distinct testing phases:

- **Alpha testing** is done by system developers to ensure that all features and functions are bug-free and operate consistently within requirements. Whether developers are in house, contractors, or off-the-shelf system vendors, effective testing at this level greatly simplifies further testing efforts and is almost essential to ensuring the reliability of the system.

- **Beta testing** is done by state or program staff to ensure that the system works properly in typical operating scenarios. Having a significant number of beta testers ultimately

increases quality by exposing the system to a wide range of operating scenarios. Effective testing requires basic competency using computers and sufficient knowledge of and experience with the state's business rules. Montana's Linda Gardner said that, state staff recruited, "*strong data entry folks* who we knew wouldn't be confused," to help with testing. Nevertheless, volunteers must be dedicated enough to follow through and provide feedback about the system. New York's Venu Thelakkat noted, "nobody is holding their feet to the fire."

- **Acceptance testing** is done by state staff and provides a final check that the system operates consistently within requirements.

- **Ongoing testing** is done by actual system users who identify issues and potential improvements as they use the system. This is not so much a formal testing phase as it is an ad hoc means of reporting problems with the system.

States that were conducting ongoing testing had one or more methods for collecting information about system issues and improvements. For example, Montana's data system sends the programmer an e-mail when a serious error occurs. In Utah, users can report a problem by accessing a link on the Web site. Rhode Island provides multiple ways for users to report issues and recommend improvements to the system.

Training and Technical Assistance

To help users become productive with a new data system and make the most of its capabilities, most states conduct pre-launch training. To provide effective training, the system should have been completed and been fairly well tested; doing so ensures that all main functions are operational and relatively bug-free. A training session may be the first time that users have experienced the new system; therefore, their perceptions of its usefulness and reliability will be affected by their use of it during the session. If issues are found during testing that affect how the program is operated, premature training sessions could deliver misinformation and confusion as opposed to assistance in adopting the new system. New York learned this lesson after scheduling its training sessions using prototypes to show how the system would operate. By the time the system went live, it had undergone a lot of changes. Although training is important for users to accept the system, the timing of training is vital.

Each state that was interviewed conducted pre-launch training and emphasized the need for ongoing training and user support:

- In Utah, state staff maintain a live online users' guide to help users keep up with changes that come with every new software release.

- In Montana, the state offers periodic training and refresher courses through Webinars as a followup to pre-launch classroom-style sessions. The state also offers NRS sessions at annual state conferences.

- In Rhode Island, user groups that include state-level staff meet once a month, and a learning community meets quarterly. The state also invites "superusers" to play a role in training.

Even on the best of systems, users ask questions and raise concerns as they enter data and generate reports. To address issues effectively, states have set up processes for accepting questions/concerns, getting answers, and managing next steps.

Utah uses an online database to prioritize and track system issues that are identified by statewide users. Technology staff members triage questions, addressing critical issues immediately and scheduling necessary system changes for the next software release. This two-tiered model of support helps to manage workload and deliver relevant levels of assistance for the needs of individual users. Routine requests are handled by state staff that have basic knowledge of the system. More complicated requests are passed along to technical staff for resolution.

Texas maintains a listserv for providing technical support. Users can pose questions to be answered by state staff or colleagues in other programs. Issues may include software bugs or methodological questions. Texas also provides indepth technical assistance by hosting two meetings a year for system users.

At system launch, Rhode Island depended highly on its system vendor to provide support, with the goal of eventually developing this capability in house. The state hosts a monthly user's group and a learning community to build capacity and expertise among program directors and other users of the system.

Managing Compliance

Although built-in validation checks and management reports are useful tools to help programs collect and use data successfully, states must get local program staff to regularly and accurately enter data that are consistent with business rules. Successful states achieve this by providing incentives and support for local staff and by providing opportunities for them to share their needs and interests with their colleagues.

For example, Rhode Island complements its software validation checks with incentives that motivate programs to enter timely and accurate student records data. By tying its funding program to outcomes as reported by the data system, programs find it necessary to enter data accurately and on time. Outcomes do not count until the data are reviewed and approved by a

program supervisor. This review-and-approval process ensures that data entry reviews are conducted, with a resulting positive impact on data quality.

Utah also ties accountability activities with student records entered into its data system. Because state staff use data in the system for desk monitoring, programs have an incentive to comply with state policies and procedures. At the same time, program directors are encouraged to use the system's built-in reports to improve their offerings and outcomes.

All of the states that were interviewed developed reports to help local programs in their everyday activities. Class lists, student profiles, posttesting reports, and other resources provide incentives to enter timely and accurate data.

Interagency Considerations

Although the data systems discussed in this guide are used as a tool for adult basic education, they often operate within a larger infrastructure of organizations with workforce, postsecondary, and other elements. Systems also receive funding from diverse sources, with each having different reporting requirements. These interdependencies complicate data collection and reporting by introducing the need to share information. Data sharing techniques, such as data matching needed to collect NRS followup measures, also raise technological, logistical, privacy, and other concerns that must be addressed.

For example, state staff in Texas wished to match student employment goals with corresponding achievements using data from the state's workforce agency. Unfortunately, because adult education is managed by a contractor, state policies prevented the team from obtaining data from other agencies. To obtain the data needed to match achievement of postsecondary goals, Texas's adult education staff had to engage a surrogate that then returned aggregate results for data matching. To overcome these challenges, Texas's state director identified partners who could help address such issues.

To facilitate data sharing, New York is in the initial stages of creating a *literacy zone* that puts adult education in with other state services, such as housing and labor. Data access across many information systems in the zone might then be simplified and standardized by creating an application programming interface.

Mary Kelly, Utah's state director, also looks at cross-agency data sharing in the larger context. Most immediately, she needed data from other agencies for matching goals and achievements. She sees adult education's UTOPIA system as a potential data source for other programs and sees value in providing access to UTOPIA for state staff in other agencies.

Concluding Thoughts

What started almost a decade ago as simple data systems to collect student records information and generate NRS reports has evolved into more complex and nuanced systems that require vision, planning, management, and technical skills. NRS data systems provide reports for the department of education and provide states and local programs with a powerful resource for managing programs more efficiently and learning how to improve their effectiveness through data analysis.

In the past, states used to sit down with their programmers and hammer out the details to build data collection software. Today, however, creating a successful data system requires a team approach. Now states must carefully assemble requirements that speak to functionality, technology, scalability, privacy and security, and ongoing system management. The greatest potential for success lies in an ability to tap the talents of individuals with a wide range of skills. This guide has touched on some key issues that were identified by decision makers in states across the country. By considering the challenges and lessons learned by others, states will hopefully develop a more effective and cohesive whole data system to meet their respective needs.