TeachME PROFESSIONAL DEVELOPMENT
CEUs for Teachers and Educators

Utilizing Data to Improve Student Knowledge and Outcomes

Part 1:

Chapter 1: Personalized Learning in Schools, Districts, and States

Introduction

Educators employ different methods of teaching and learning to help their students succeed. One such method is personalized learning, which aims to tailor instruction to the needs, talents, and skills of each individual learner. Rapid advances in technology platforms and digital content over the last decade have enabled more widespread use of personalized learning. As a result, many schools and districts may be interested in expanding its use across various content areas and grade levels. Effective personalized learning requires the collection, understanding, and use of data across many variables. Schools and districts that are interested in implementing personalized learning need to be prepared to ensure the data access, data privacy, and time and training to use data that are necessary to making personalized learning scalable.

This document is intended for those districts and states that may be interested in personalized learning.

This document is designed to assist education agencies as they consider whether and how to expand their use of personalized learning. It provides an overview of personalized learning and describes best practices used by education agencies to collect data for personalized learning; to use those data to meet personalized learning goals; and to support the relationships, resources, and systems needed for effective use of data in personalized learning. It also provides a particular focus on data considerations needed by different locations depending on their approach to personalized learning, and considers questions such as which data elements are appropriate at the district or state levels. Because personalized learning is still a developing prospect in many locations, the concepts and examples provided here are intended to help facilitate idea sharing and discussion.

Defining Personalized Learning

Many leading educators and researchers have contributed to recent conversations about personalized learning, yet there is no single, agreed-upon definition of the practice. Definitions from various organizations include several common elements, but may vary in specificity and explanation. This document will use the definition provided by the U.S. Department of Education's Office of Educational Technology (2017):

> Personalized learning refers to instruction in which the pace of learning and the instructional approach are optimized for the needs of each learner. Learning objectives, instructional approaches, and instructional content (and its sequencing) may all vary based on learner needs. In addition, learning activities are meaningful and relevant to learners, driven by their interests, and often self-initiated.

Beyond having varying definitions, districts and states also vary considerably in how they put their concepts of personalized learning into practice. As the examples in this resource will show, personalized learning programs across the United States vary from individual projects completed outside the classroom to full-scale implementation of individualized learning plans and assessment of mastery either within classrooms or systemwide. In addition, some locations have statewide personalized learning endeavors (e.g., Vermont), while others either have district-based programs or are developing programs that feature either initial pilot districts or state-level support for particular personalized learning tasks. For example, Utah currently has a pilot program of 13 districts that are incorporating personalized learning and mastery-based assessment into their larger digital learning plans, whereas Idaho offers assistance to students through personalized online courses and to districts via support for content and infrastructure. Finally, there is wide variation in the grade levels targeted by personalized learning programs across the country: some focus specifically on elementary or middle school, some offer personalized plans in high school aimed at preparation for postsecondary options, and some allow personalized learning approaches or projects across all grade levels. At this point, there is wide variation in how states and districts are designing and implementing personalized learning, and their choices often reflect the nature of their size, location, and funding options.

What Personalized Learning Is Not

When defining personalized learning, it is important to clarify what it is not. Personalized learning does not, for example, necessarily require all students to have their own device (e.g., a tablet), nor does it equate to isolated learning. Schools can incorporate many personalized learning tasks without having a vast number of devices, and students should engage in collaborative activities with peers as well as individual tasks (Rhode Island Office of Innovation 2017). Additionally, personalized learning does not leave students to learn without guidance or to "teach themselves." While responsibility for one's learning and self-guided tasks are goals of personalized learning, the teacher's role remains central (Pane et al. 2015). In fact, the ongoing guidance and feedback in this approach mean that many students will have more one-on-one time with their teachers than in a traditional classroom model.

Personalized learning does *not* require all students to have their own devices.

Personalized learning does *not* mean learning in isolation.

Perhaps most importantly, personalized learning does not require technology. Educational technology does not equal personalized learning, but technology is a tool to facilitate and enable personalized learning. It can provide teachers and students with expanded options for accessing and learning information, as well as varied ways of reaching and demonstrating mastery of content. Additionally, recent advances in technology have allowed many states and districts to bring personalized learning to scale in ways that were not previously possible. Figure 1 describes what personalized learning is not.

Technology is a tool to *facilitate* and *enable* personalized learning.

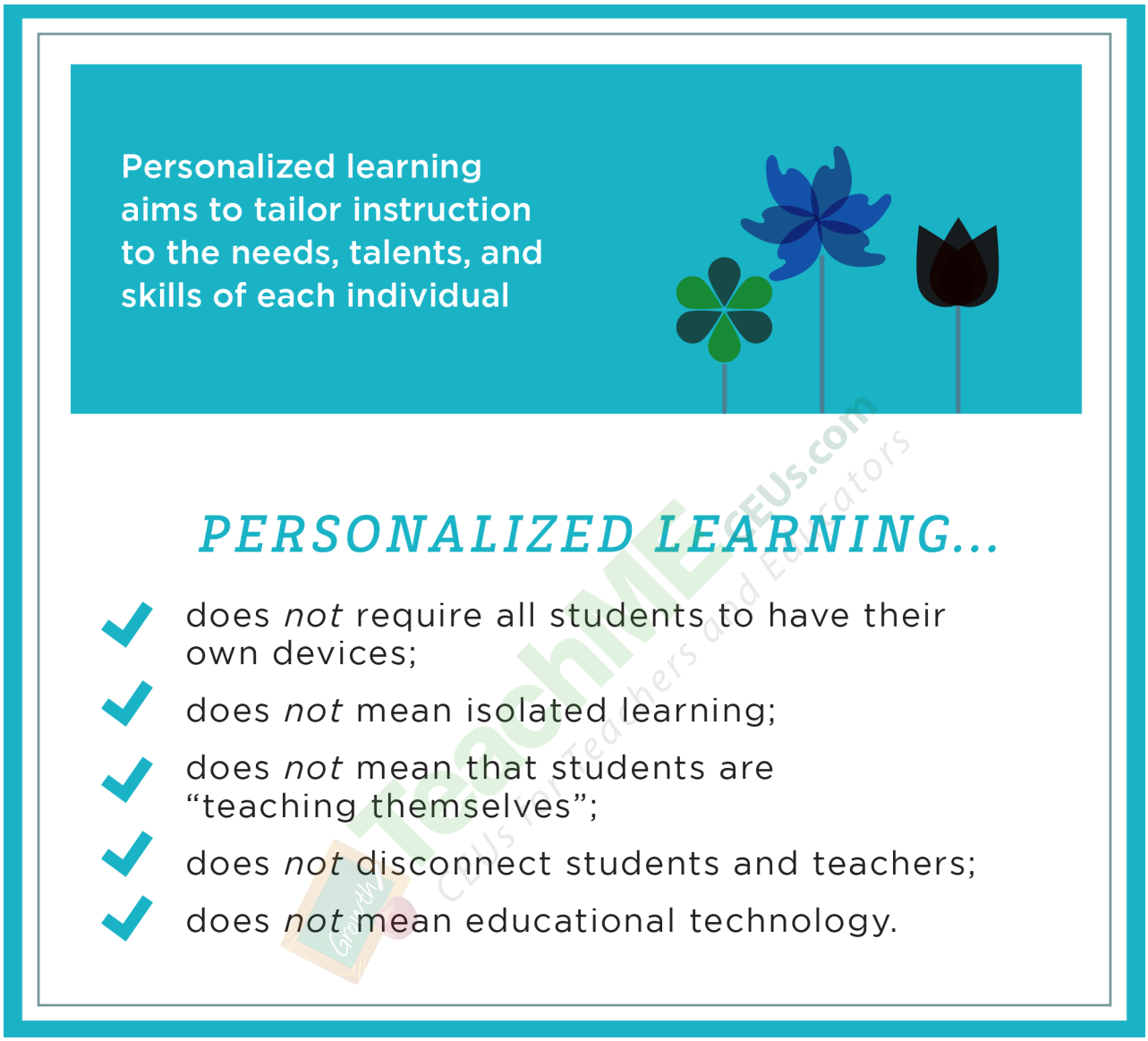

Figure 1. Personalized learning

Key Terms in Personalized Learning*

Attendance – Attendance in an instructional program approved by the school, district, and/or state (National Forum on Education Statistics 2018).

Competencies – Systems of instruction, assessment, grading, and academic reporting that are based on students demonstrating that they have learned the knowledge and skills they are expected to learn as they progress through their education.

Data-Informed – Determined by data rather than set schedules or prior experiences. In personalized learning, data about students' knowledge, interests, and progress are used to help determine their needs and design their learning activities.

Digital Content – Information available for download or distribution on electronic media, which may be digitally broadcast, streamed, or contained in computer files.

Digital Learning – Learning facilitated by technology that gives students some element of control over time, place, path, and/or pace.

Experiential Learning – Learning that occurs through experience, with a specific focus on learning through one's reflection on those experiences.

Formative Data – Data collected from a range of formal and informal assessment procedures conducted by teachers during the learning process in order to adjust teaching and learning activities to better meet student needs.

Individualized Learning – Instruction and learning designed to meet the unique pacing of each student. Academic goals remain the same for the class or group, but individual students can progress through the curriculum at different speeds, based on their own particular learning needs.

Learner Profile – A detailed summary of data relevant to an individual student's personalized learning, such as academic history, particular interests and skills, and personal motivations for learning.

Learning Objectives – Brief statements that describe expectations for student learning (including content, skills, and activities) within a given span of time.

Mastery – Demonstrating comprehensive knowledge of content or skill in a particular area.

Mastery-Based Learning – Instruction and assessment focused on the demonstration of knowledge of content, without adherence to traditional instructional schedules. Mastery may be demonstrated in varied ways and at different times by individual students.

Performance Assessment – Observing a demonstration of knowledge acquired, skills gained, or readiness to move to new content.

Student-Centered – Based on the needs and interests of the student. Student-centered learning focuses primarily on the activities of the student rather than those of the teacher.

Sustainability – The ability to be maintained at a certain rate or level. In education, this typically refers to a program or initiative maintaining the funding, resources, and overall support needed to continue.

Tailored Instruction – Instruction specifically designed to meet the needs of each student. Teachers may differentiate content, learning processes, the learning environment, or student groupings to best address varying levels of knowledge, skills, and needs.

*Note that this is not a comprehensive list.

Chapter 2: Key Concepts for Personalized Learning

The different paths some states and districts have taken in their development of personalized learning plans mean that they may have different specific needs in terms of resources and materials to support their efforts. However, educators and researchers focusing on personalized learning consistently highlight several key concepts, including

- instruction and content tailored to student needs;
- a focus on content mastery;
- the use of data-informed, real-time feedback; and
- effective use of technology.

Within each of these areas, schools and districts select data elements to facilitate the collection and strategic use of student information.

Tailored Instruction

Within a personalized learning model, instruction includes rich learning experiences intended to accelerate and deepen student learning, and the teacher's role is to design and manage the learning environment in order to provide students with expert guidance and support, helping them take increasing ownership of their learning (Pane, Steiner, Baird, and Hamilton 2015). Individualizing content may include matching components of instruction to students' particular interests and experiences (Walkington 2013).

Tailored Instruction in Practice

Team Yellowstone, a "school within a school" in Sacajawea Middle School in Bozeman, Montana, changed from the traditional school schedule to longer blocks for core subjects, which allow students to investigate subjects of interest and work with peers in project-based learning. Students also focus on core subjects during a particular part of the year (e.g., social studies in the fall and science in the spring), which allows time for deeper study.

Personalized learning is supported by instructional materials that are flexible enough to meet the varying needs of students over time. These materials are complemented by targeted instruction that aligns to specific student needs and learning goals. Teachers may move among different teaching methods and strategies, such as small group, one-to-one, or whole group discussion, depending on changing needs (Johns and Wolking n.d.).

As teachers tailor instruction, they may use both formal and informal means of gathering information and identifying student needs. Formal structures such as assessments or scheduled observations provide important information, but teachers also draw significant amounts of information from conversations and direct interactions with students. The relationship between teacher and student is critical to tailoring instruction: teachers need to remain cognizant of their students' achievements and challenges, as well as their varying needs across time.

Learner Profiles

In order to optimize learning experiences and classroom activities for each student, a teacher needs detailed knowledge of their needs, strengths, interests, and mastery of different competencies. Many teachers collect and maintain information for tailored instruction by creating learner profiles for their students that help track and analyze student data across multiple variables. These variables can include individual learning information such as learning history, potential barriers to learning (e.g., personal or emotional issues), and academic supports currently in place, such as individualized education programs (IEPs). Profiles may also include the student's academic status; information about particular learning strengths and skills; and particular motivators for learning. Depending on the location, the learner profile might be tracked and updated via a spreadsheet, online application, or dashboard. Each profile is established by the teacher and the student, so that it best represents the student's goals and specific learning data. This co-creation also allows the profiles to be tools in students' ownership of their learning.

> "You can't motivate a kid you don't know."
> ~ teachers' motto at Montana's Team Yellowstone

As part of a Statewide Personalized Learning Initiative launched in 2016, Rhode Island implemented learner profiles for students. These profiles provided a framework for personalized learning plans, and they helped teachers create plans to close learning gaps, support students in exploring learning objectives at a deeper level or at an accelerated rate, and help students plan for college or a career (Rhode Island Office of Innovation 2017).

Learner profiles are also used in schools where personalized learning may be centered on particular projects rather than general classroom time, such as in Connecticut's Meriden School District. In Meriden, students develop proposals for personalized learning experiences that allow them to pursue areas of personal interest and potentially work with professionals or mentors in that area. These projects are monitored by teachers who have volunteered to work with the personalized learning activities, who work with the students to develop projects that challenge them and meet requirements under state standards. These teachers also coordinate with Personalized Learning Coordinators at the schools, as they work together to meet individual student needs while maintaining academic rigor.

Vermont's Learner Profiles

As part of the state's Personalized Learning Plans (PLP), teachers in Vermont work with students to compile key information across different areas related to learning and help them develop their PLP. While districts are given the flexibility to specifically define how these plans are developed and structured, state leaders provide a set of critical elements to consider to help guide educators in their work. These critical elements are summarized below:

Plan Information

- Student name and student ID
- Name of school
- Date of initial plan development
- Dates of each update and/or ensuing meetings
- Participants in each development meeting listed [e.g., student, family member or advocate, advisor/mentor, core teacher(s), etc.]

Student Profile

- Student strengths, abilities, and skills
- Student core values
- Baseline assessments results

Student Goals

- Secondary school goals
- Post-secondary goals

Action Steps

- Student goals action steps
- Post-secondary goals action steps

Achievement of Action Steps

- Progress toward meeting student goals
- Progress toward meeting common learning expectations and goals (as a means to measure student growth, achievement of action steps, and goal attainment)
- Assessments could include baseline assessment results, evidence of student learning, benchmark assessments, performance assessment, self-assessment, peer assessment, formative assessments

Reflection

- Student self-evaluations
- Parent/guardian reflection
- Teacher/advisor(s) reflection

Revision

- Documentation of the revision process including edits, amendments, improvements, alterations, etc.; correspondence of revisions with reflections, etc.
- Once revisions are finalized the following would be included in the goals and action steps: updated short-term and long-term goals; updated action steps; transition plan (if applicable)

Content Mastery

In addition to individualized content and flexible instruction methods, personalized learning models tend to incorporate different means of assessment of student knowledge and progress than those used in traditional classroom models. Many plans focus on students' mastery of content, in which students demonstrate comprehensive knowledge of content or skills in a particular area to indicate their academic progress. This is in contrast to the traditional, time-bound content progression, in which lessons have a set schedule and length of time and all students move on together to learn new content despite differences in mastery.

A focus on mastery of content, rather than strict instructional timelines, provides students greater ownership of their own learning, as well as more choices in their learning processes. For example, some teachers allow students to choose how they want to demonstrate mastery of a given concept or subject—for example, the choice between writing an essay or building a model—or to choose to explore a particular topic at a deeper level or for an extended period of time. To facilitate student engagement, teachers can construct personalized learning environments in which students are given ownership over some aspects of their learning. They can also support students as they develop and practice habits of success, allowing the students to increasingly monitor their own progress (Rhode Island Office of Innovation 2017).

Data-Informed, Real-Time Feedback

Effective use of data provides the foundation for learning to be individualized: teachers and students know where the student is in terms of understanding content, mastering skills, and meeting educational goals. Meaningful data collection and use gives teachers a more complete understanding of their students' progress, and allows them to use the technology and tools available to craft lessons and experiences specific to their students' needs (Data Quality Campaign 2016). Frequent data collection about students' comprehension and mastery of content, as well as their learning goals and experiences, provides a basis for instructional decisions and effective grouping of students. Formative data (that is, data collected during the learning process) allow teachers to identify trends and areas that need improvement, and to modify their instruction to meet specific needs of students (Johns and Wolking n.d.).

Educators should meet frequently within instructional data teams to review information and make decisions about individual student needs; use data to provide immediate, targeted feedback to students; and use regular formative assessments to inform instruction (Johns and Wolking n.d.). In Ohio's Forest Hills School District, for example, teacher teams work together to analyze data about individual students, make instructional and intervention decisions, and plan useful learning experiences. At a higher level, teachers and administrators may work with data analysts or evaluators to assess and discuss aggregated data, in order to make decisions at the school or district level. Similarly, district leaders work with data experts at the state level, who offer data analytics and feedback to guide decisionmaking, as well as other types of training and guidance. These feedback loops provide a continuing flow of data that inform and facilitate personalized learning.

In many districts, students also have access to their data and an understanding of how to use the data to set and work toward learning goals. With data about

Focusing on Student Data

Working with data is critical even in smaller personalized learning endeavors. In Bozeman, Montana's Sacajawea Middle School, the two teachers of Team Yellowstone have daily discussions about classroom data for the program's 60 students; these discussions inform students' goal setting and teachers' instruction.

their progress over time, students can see the areas or skills that require more time and attention, and this knowledge allows them to take more ownership of their learning (Data Quality Campaign 2017). They are encouraged to work with their teachers in using their data to understand their progress, plan for their upcoming tasks, and work toward further mastery. Data provide students the chance to reflect upon their learning, identifying the successes and challenges that then inform their goal-setting and choices.

A focus on student comprehension and use of data can be seen in Minnesota's Personalized Learning Plans (PLPs), in which high school students are required to develop plans for their future goals, which may include higher education and/or the workforce. Each student's individual data profile includes information about their academic knowledge and skills, personal learning styles, and options for the future. It also includes data on experiential learning opportunities they may have had, such as site visits, job shadowing, mentoring, or internships.

Districts and charter schools may also purchase programs that allow students to develop their PLPs. These systems may also allow them to research information about colleges, occupations, funding, and other areas that may affect their future plans. Students use all of this varied information to develop a personalized plan for their future, with the support of teachers and administrative staff.

"Kids are highly motivated by data that are meaningful to them."
~ perspective from data leaders in Westminster Public Schools (Colorado)

Effective Use of Technology

Teachers have long known that students vary in their skills, talents, and educational needs, and have designed and modified their practice in various ways to best serve their students. Until recently, however, these teachers have made these adjustments and varied their methods largely on their own, without specific support from administrators or targeted tools and resources (Digital Promise 2016).

Technology now allows meaningful personalization based on more specific and ongoing data about the learner (Digital Promise 2016). New technologies, as well as advancing methods of data collection and use, enable teachers to quickly see the progress of each student on various tasks and lessons, and to provide differentiated feedback and formative assessments (Rhode Island Office of Innovation 2017). For example, personalized learning is enabled by smart e-learning systems, which help continually track and manage students' learning needs. These systems also provide a platform to access the dynamic learning content, resources, and learning opportunities needed to meet widely varying student needs (Wolf 2010).

Using Technology to Enhance Personalized Learning

Technology can help teachers

- assess students' strengths, needs, and expanding mastery;
- select, manage, and deliver curriculum;
- provide students access to targeted resources; and
- use e-learning management systems to track learning needs of students and classrooms.

Offering students opportunities to use preferred technology can also increase student engagement. Because many students use a wide range of emerging technologies outside of school to support their learning, their classroom work might be encouraged and facilitated by the chance to use these technologies during the school day (Project Tomorrow 2012).

Finally, recent technology has allowed personalized learning to be brought to scale on a level that was not previously possible. While technology can play a key role in delivering and supporting instruction, it also enables educators to collect and analyze the sometimes complex, detailed data needed to support personalized learning. Educators may have multiple means of recording, sharing, and analyzing data, as well as then offering feedback to students or colleagues.

Managing Multiple Platforms

The vast array of technologies available to support personalized learning means that educators may be working with multiple applications and service providers. Managing the increasing role of private providers is an important governance consideration for states and districts.

Chapter 3: Personalized Learning Data

The collection and use of meaningful data are integral to the programs discussed throughout this document. Data about individual students and their learning activities allow teachers to see the trajectory of progress across different academic competencies and assess students' levels of mastery of information or skills. These data also allow teachers to make plans appropriate to the particular needs and skills of the students, and data can be used for both short- and long-term planning of lessons and other educational activities.

Data also allow schools, districts, and states to assess the needs, challenges, and successes of personalized learning plans. By asking targeted questions and collecting the data needed to answer them, education leaders can see what is working and what needs to be adjusted, assess how to distribute resources or education staff, and determine future needs (fiscal and otherwise).

Categories of Personalized Learning Data Elements

Data associated with personalized learning can be categorized into the following six major areas:

- Program structure and design
- Curriculum and instruction
- Student learning objectives
- Mastery and competencies
- Support systems
- Budget and finance

Table 1 lists each category and provides examples of the types of questions that might be addressed from related data.

Categories of Personalized Learning Data	Related Data	Examples of Questions That Might Be Addressed From Related Data
Program Structure and Design	• Calendars • Schedules • Task Leads • Assigned Responsibilities • Enrollment	• What is the schedule for implementation? • When will specific tasks be completed? • Who is responsible for particular tasks or activities?
Curriculum and Instruction	• Academic Content • Curricula • Instructional Models • Class Plans	• What specific content will students address? • How will the content be delivered? • What will the teacher role be in various activities?
Student Learning Objectives	• Learner Profiles • Academic Targets • Personalized Plans for Activities	• What are the goals for each individual student? • Which data elements are in a given student's learner profile? • What are the intended means to meet these objectives? • What is the student's progress toward individual goals, as well as state standards?
Mastery and Competencies	• Competencies • Mastery Frameworks • Mastery Levels • Assessment • Portfolio Reviews • Graduation Requirements	• How will students show mastery of particular content? • What are the competency levels in different areas of learning material?
Support Systems	• Metadata • Training • Professional Development • Personalized Learning Coaching • Parental Engagement	• How will the varied aspects of the agency's overall plan for personalized learning be supported? • How will teachers be supported? • How will parents and other stakeholders be engaged?
Budget and Finance	• Budget Information • Local and State Funding • Grant Funding	• What is the funding structure? • How does it break down among local, state, or grant funding? • How are particular program elements funded?

Table 1. Categories of personalized learning data elements, related data, and example questions that might be addressed

Structured and Unstructured Data in Personalized Learning

An additional consideration in data collection and use for personalized learning is the difference between structured and unstructured data, and the variations in how each are used. The term *structured data* generally refers to data that can be collected via a learning management system, such as student, course, or curricular data (Gudivada 2017). The term is used to refer to information with a high degree of organization, so the data are easy to store and search within a relational database (one that is structured to recognize relationships among stored items of information) (BrightPlanet 2012). *Unstructured data* refers to data that are not structured via predefined data models or schema. Unstructured data may include text or non-text data, and may be either human or machine generated (Taylor 2017). Within personalized learning, unstructured data could include communications between teachers and students, or among student teams; they could also include teacher observations of students' reactions to classroom activities or interactions with others. This information can be used in real time to tailor instruction.

In addition to differences in the nature of these two types of data, analysis of structured data tends to be simpler than that of unstructured data, based on the greater organization and easier searchability of structured data. More advanced analytics tools exist for structured data, whereas those for unstructured data are newer and less developed (Taylor 2017). However, analysis of unstructured data for personalized learning may hold great promise, as it may reveal more about individual students' behaviors and ways of thinking that provide important insights related to those students' understanding of content. As education data teams work toward more sophisticated methods of data analysis for personalized learning programs, they are likely to expand upon the possibilities for using these two types of data, and to explore the potential for analyses that integrate the two.

Considerations for Personalized Learning Data

In addition to understanding the categories and types of data used for personalized learning, there are several other data-related considerations that may be relevant for educators at various levels. Schools, districts, and states should have existing data governance processes and procedures in place for all data collection, use, and reporting. These agencies need to consider how personalized learning data, which may be different from other data, will adhere to these processes and procedures. Questions to consider include the following:

- Who has access to various types and levels of data, and for what purposes?
- What data will be collected that are specific to individual students, and how will personally identifiable information (PII) be protected?[1]
- Which data are primarily for individual learning support and teacher/student interactions, and which are primarily for program evaluation and improvement? How and when are these two categories connected?
- At what levels will the data be aggregated and for what purposes?
- How do personalized learning data fit into established data reporting structures? If new structures are needed, how will the data be reported to different audiences and/or for different purposes?

[1] For more information, see resources available from the U.S. Department of Education's Privacy Technical Assistance Center (https://studentprivacy.ed.gov/). In addition, see chapter 4 of this resource for a more extended discussion of data privacy.

Chapter 4: Strategies to Support Personalized Learning

Create a Strategic Plan

If educators and leaders are planning to use personalized learning, it is important to first define expectations and goals for the program and have discussions about how success and challenges will be defined and measured. Practical elements must be clarified and planned as well. Needs assessments can identify the resources already in place, as well as what types of investments will be necessary—whether in terms of personnel, training, technology, or other tools.

As education agencies consider using personalized learning, they should establish measurable goals, have clear plans for collecting and managing data, and define timelines and expectations. Although many locations have transitioned into personalized learning in a piecemeal fashion, those that have been the most effective (and able to sustain their efforts across time) have been those who engaged in deep discussion and careful mapping of the plans beforehand. Questions to ask when developing a personalized learning plan include the following:

- Who will perform which tasks, and when?
- Is the agency's plan for moving into personalized learning designed to increase gradually or in steps, and if so, what will these specific steps be?
- What data currently exist in the data system, and what additional data will need to be collected?
- At what rate are expansions of the plan expected to happen?
- What types of assessment will be implemented, both for individual student progress and for the initiative overall?
- How will teachers determine when a student's personalized learning goals are achieved?
- What level of training may be needed for teachers prior to the program, and what kind of mentoring or coaching may be needed as the effort is implemented?

Needs Assessment

It is critical that schools and districts that are planning to implement personalized learning have clear goals and plans for developing needed resources and tools. Teachers have indicated that they often face struggles in three areas when integrating technology into their lessons: executive issues, such as managerial or financial problems; infrastructure problems, such as technological or physical challenges; and instructional concerns, such as inadequate materials or underdeveloped teacher competencies (Vatanartiran and Karadeniz 2015). Education agencies need to be ready to recognize and address these challenges in order to move forward successfully. When developing resources for an educational shift such as introducing personalized learning, schools and districts commonly go through a three-phase plan of needs assessment, resource building, and resource implementation (see figure 2).

Figure 2. Needs assessment process

Needs assessment is a process through which an organization defines its specific needs. "Needs" can be understood as the gap between the organization's current environment and its desired environment (National Forum on Education Statistics 2005). The assessment identifies gaps in resources and capabilities based on numbers and types of stakeholders, existing knowledge or materials, prior training, current technology, and other categories relevant to the particular change or transition.

In addition to identifying gaps in needs, the needs assessment process can help a state or district

- determine priorities and allocate potentially limited resources;
- align goals, strategies, and outcomes (for example, by making sure the personalized learning project aligns with the agency's strategic plan);
- provide direction and tools for the program; and
- enable monitoring of the program as it is implemented (O'Reilly 2016).

In the *resource building* phase, an education agency moves forward with the information gained from the needs assessment and begins to collect the resources necessary to meet identified gaps. Resource building may involve working through required financial processes for obtaining and purchasing new technology, software, or curricular materials; or it may involve a process of identifying and arranging appropriate training or professional development options. Throughout this phase, instructional teams, administrators, and technology experts need to stay in close contact to ensure that resources for the transition are being designed and prepared in ways that align with the intended project goals.

In the *resource implementation* phase, the agency moves forward with putting the transition in action, and thus implementing those resources identified by the needs assessment and developed during resource building. During this time, the school or district moves through the designated steps of the plan, and will collect data and make assessments as resources are introduced and integrated into classrooms. This allows them to review feedback from stakeholders and make adjustments where needed.

Modify Infrastructure and Learning Environments to Support Personalized Learning

While personalized learning does not require technology, most modern personalized learning plans do include technological options, as well as data systems to collect and analyze personalized learning data. Therefore school systems should have the infrastructure in place to support these parts of the process. When used effectively, data enable teachers to see a fuller picture of their students' progress and adjust lessons and learning tasks accordingly (Data Quality Campaign 2016). School and district leaders can support teachers' use of data by providing the data tools and systems to facilitate data use, as well as restructuring learning environments to minimize data burdens (i.e., collecting, managing, and reporting data) and allow teachers to focus on instruction and scaffolding lessons (Bill and Melinda Gates Foundation 2015). They can provide further support by vetting and choosing personalized learning systems, devices, and tools, as well as providing high-quality materials, curricula, and assessments aligned with personalized learning goals (Rhode Island Office of Innovation 2017). Leaders need to provide guidance and support to ensure that teachers understand and see the value in data, and are knowledgeable about how different types of data (such as individual student data vs. aggregate data) will be used.

Personalized Learning Spaces

Classrooms in Ohio's Forest Hills School District are designed based on the "caves, watering holes, and campfires" concept and provide multipurpose learning spaces for individual, small group, and large group learning. The district is also working to provide "makerspaces" in all schools.

Part of this restructuring also includes providing the training, professional development, and classroom support needed for teachers to become skilled as they incorporate personalized learning into their teaching. Ohio's Mason City School District, for example, provides teachers with specific professional pathways for personalized learning, and has them work with personalized learning coaches and participate in professional development opportunities to work with colleagues and expand upon what they have learned. In Ohio's Forest Hills School District, leaders have created a districtwide shared curriculum, encouraged teachers to explore how students can meet standards, and provided instructional coaches. In Vermont, a personalized learning working group, made up of a variety of different stakeholders, has developed resources and guidelines for teachers and schools, provides ongoing guidance, and offers collection mechanisms for personalized learning data.

Developing the competencies needed to successfully provide and support these programs takes time. School leaders can best support their staff by thinking strategically about the roles different stakeholders play in the process, and considering creative transitions such as new staffing models and more flexible learning environments (Rhode Island Office of Innovation 2017).

Data Systems

A critical part of creating an infrastructure that supports personalized learning is ensuring that data systems can capture personalized learning data. As states and districts create and expand their personalized learning programs, they need to consider how personalized learning data collected will or will not be entered, housed, and utilized within their data systems. Education leaders should discuss what personalized learning data they plan to collect, intentions for their use, and potential relationships among these data and the data currently collected in that location (this could include both student academic data and standard district- or state-level compliance data). The issue of interoperability is particularly important: data should be able to move accurately and effectively between applications in order for teachers to receive and use data to successfully meet student needs.

The National Forum on Education Statistics resource *Forum Guide to Building a Culture of Quality Data* (https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2005801) provides additional guidance relevant to modifying existing structures and systems.

Interoperability refers to the seamless, secure, and controlled exchange of data between applications.

(Project Unicorn 2018)

States and districts vary in the level to which they are integrating personalized learning data into their student information systems (SIS). Many are still working with stakeholders to determine the full scope of data that will be collected, and plan to move from there to clarify how these data can be included in their current systems. Others are leaving the responsibility for and control over personalized learning data to individual teachers—allowing them to use

these data for learner profiles and educational planning—without plans to then move the data up to data systems at the school, district, or state level. (In some of these cases, teachers do report student progress based on mastery- or competency-based assessments.) Some districts do work with personalized learning data at the district level, but have often faced challenges. Ohio's Forest Hills School District, for example, found that as the nature and complexity of the data collected for personalized learning grew, they needed to upgrade and expand their system to one that was more dynamic and able to meet higher-level needs. Connecticut's Meriden School District has faced obstacles when students' personal learning projects have continued into the summer, making it difficult to incorporate the related data into the system for that school year. Overall, the current state of personalized learning data and agencies' data systems is in flux in many locations, as leaders continue to clarify program details and learning goals.

Incorporating New Data into Data Systems

Prior to incorporating new types of data into data systems, it is important that agency staff plan carefully; involve appropriate stakeholders; and review federal, state, and local laws, regulations, and policies to determine whether the data may be collected.

Data collected for assessment of personalized learning do not always fit easily into existing data systems. Data systems that are set up to record numerical data, such as assessment scores or letter grades, may not be able to accommodate new types of data collected as part of personalized learning. For example, Ohio's Mason City School District allows students to provide artifacts related to their experiences outside the classroom, such as photos of museum visits or photo collages of service work completed. These items are considered evidence of learning, but do not lend themselves to typical data assessment. These data from the district's "Personal Learning Days" are not logged into the SIS. Similarly, Team Yellowstone at Sacajawea Middle School, in Bozeman, Montana, has been able to incorporate student engagement survey data into the school's SIS, but the data they collect from project-based learning tasks or mini-conferences with students continue to be used at the classroom level and are not entered into the larger school system.

Use of student data also depends on the nature of personalized learning efforts in a given location. In Utah, pilot districts in the state's Digital Teaching and Learning Grants program are navigating the transition to competency-based assessment and moving from letter grades to competency scales (in which students' efforts are rated 1-4). This switch to competencies has also included a shift in course requirements at the middle school level: students can take types of courses (provided they earn a specified number of math credits) and move through the material at the rate at which they reach and can demonstrate mastery over the content. This is an important shift from students being required to take a particular sequence of courses in a given subject. It has also required the state to consider the issue of equivalencies: that is, how to switch between competency ratings and grades if a student moves in or out of a pilot district and a transcript needs to be evaluated. This question of credit and transcript transfer has come up for many districts and states working with personalized learning and mastery-based assessments.

In one part of its personalized learning efforts, Idaho tracks and transforms student data using a mastery-based badging system called SkillStack, in which students who have demonstrated mastery of particular content can earn related badges. These badges can then equal university credit in a subject or equate to completion of a career and technical education (CTE) competency.

Plan for the Sustainability of Personalized Learning

The ways in which states and districts fund personalized learning programs and activities vary considerably. Funding streams differ, as do the particular needs of each agency. Education leaders need to consider their particular needs in terms of technology, professional development and training, resources, and other supports—and assess how these needs align with their fiscal options. Additionally, policies and regulations influencing the continuing sustainability of education initiatives vary among states and districts, and need to be considered and integrated as appropriate when transitioning to personalized learning.

Financial Sustainability

The states and districts highlighted in this resource have developed different approaches for funding personalized learning efforts. Forest Hills School District draws funds from the general fund curriculum budget. Idaho has a mixed funding model that combines state funds (about 65 percent) with funding from the districts that are users of the Idaho Digital Learning Academy. In Vermont, Flexible Pathways Education Fund Grants are appropriated each year that support districts in their implementation of personalized, proficiency-based learning, and the state has also received intermittent grant funds to support state-level parts of the personalized learning plan. The districts in Utah's pilot program receive grants through the Digital Teaching and Learning Grant Program, created and funded by the state legislature. Connecticut's Meriden School District received a grant from the Nellie Mae Foundation to fund its efforts. Across these different locations, the nature and source of funding has both been driven by and influenced the scale and type of personalized learning program that has been developed.

The Office of Educational Technology (OET) at the U.S. Department of Education offers a set of fundamental questions states and districts should consider when financing digital learning (which can often be a component of modern personalized learning; see figure 3):

- What resources are presently available in schools, and how are they distributed?
- What are the 1-, 3-, and 5-year goals in terms of digital learning?
- What devices do students already bring to school? How do they use those devices?
- How fast are the internal and external connections in schools? How fast must they be to meet students' and educators' needs?
- What are the major strengths and challenges this area has in terms of technology?

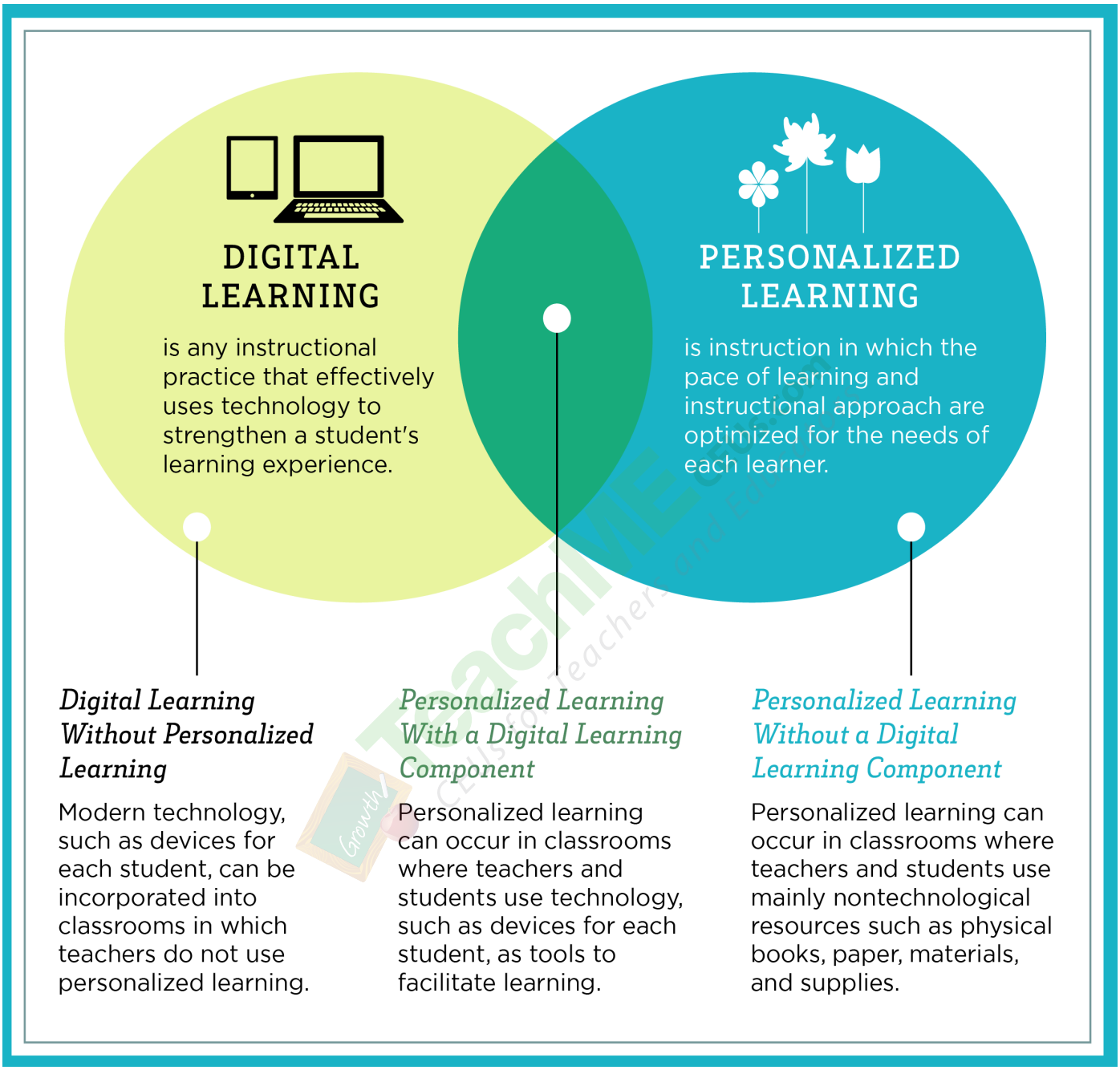

Figure 3. Digital versus personalized learning

OET also suggests that districts and states consider issues such as collaborating with others to leverage economies of scale (that is, get favorable prices from vendors by sourcing technology together); developing public/private partnerships; coordinating across agencies (such as K-12 working with higher education) to acquire technology; and refurbishing existing or donated devices. They note that because states and districts are at different points in their digital learning development, varying levels or combinations of these options may work best (Office of Educational Technology 2018).

Though grant funding is often part of a state's or district's initial personalized learning plans, this type of funding is usually for a specified period of time, and education agencies can experience financial difficulties if they do not plan how to sustain the initiative over time. The Matanuska-Susitna Borough School District in Alaska advises that leaders consider the following questions when strategically planning the use of grant funding (Flint 2017):

- What is our short-term implementation plan once we get the money?
- What is our long-term plan for sustaining grant objectives?
- How will we maintain materials and tools purchased with the funding?
- How will the grant impact our current staff (and will we need to hire someone new)?
- How will the education goals be sustained after the grant ends?

Policy Considerations in Sustainability

Leaders at different levels—school, district, or state—should be aware of the relevant policies that may influence the sustainability of personalized learning in their location, and consider what is needed to work within these policy frameworks. At the school and district level, personalized learning may need to be integrated into existing policies or regulations for grading, scheduling, or learning environments. If there are potential conflicts (such as a mastery-based personalized learning plan not aligning with standard letter grades), educators and leaders need to investigate possibilities for mitigating these conflicts, and establish plans that will allow personalized learning to be successful. At the state level, key elements of personalized learning may conflict with policies related to grade-level progression or graduation, or state standards for content and assessment. Just as at the district level, leaders must consider and plan for these potential issues prior to transitioning to personalized learning.

Ensure the Privacy of Personalized Learning Data

The privacy of student information is a key concern for education agencies, at both the local and state levels. The federal Family Educational Rights and Privacy Act (FERPA) requires the protection of the privacy of student education records, requiring specific processes be in place to ensure that parents (and students, after age 18) have certain fundamental controls over how and with whom education records are shared (U.S. Department of Education 2015). Additionally, many states have laws in place regarding privacy of student data. As data systems expand and data are used for more purposes, however, there is increasing concern about the potential vulnerability of student data, as well as issues related to cloud-hosted data, data destruction, and data ownership.

The U.S. Department of Education's Privacy Technical Assistance Center (PTAC) has developed numerous resources to help schools, districts, and states address concerns and ensure the privacy of student data. These include *Protecting Student Privacy While Using Online Educational Services: Requirements and Best Practices* (https://studentprivacy.ed.gov/resources/protecting-student-privacy-while-using-online-educational-services-requirements-and-best), which addresses privacy and security considerations relating to student use of computer software, mobile applications (apps), and web-based tools in the classroom; *Integrated Data Systems and Student Privacy* (https://studentprivacy.ed.gov/resources/integrated-data-systems-and-student-privacy), which covers a broad range of student privacy issues that education agencies must consider when using information from integrated data systems to guide decisions about programs and policies; *Cloud Computing FAQ* (https://studentprivacy.ed.gov/resources/cloud-computing-faq); and *Best Practices for Data Destruction* (https://studentprivacy.ed.gov/resources/best-practices-data-destruction). Additional PTAC resources are available at https://nces.ed.gov/programs/ptac/.

Further information about student data privacy and FERPA can also be found in the *Forum Guide to Education Data Privacy* (https://nces.ed.gov/forum/pub_2016096.asp).

Develop and Maintain Support Structures

In addition to creating a strategic plan for the design and implementation of personalized learning, education agencies should also plan for how the transition will be supported. Support for teachers at the school level, as well as broader support from the district and state levels, is key to sustaining and expanding personalized learning.

Support for Teachers to Effectively Use Data

Data collection and use help to ensure the success of personalized learning efforts. Data help teachers make decisions about students, resources, and available technology based on what they know about their students' status and progress. Understanding the strengths, needs, preferences, and mastery of individual learners can help teachers engage, motivate, and inspire their students, as well as provide them with the right resources at the right time (Digital Promise 2016). Administrators can support teachers by recognizing that teachers need ample training and support when learning to make data-informed decisions about students (Johns and Wolking n.d.), and by valuing and modeling good data use practices. In addition, teachers should be provided time for thoughtful reflection about data and their potential use for students or at the aggregate level. Finally, school and district leaders should ensure that teachers receive training about data privacy and security, as well as how to communicate about data to students and parents.

Supporting Teachers Using Data

In Ohio's Forest Hills School District, teachers work in collaborative teams to understand and utilize student personalized learning data. Collaboration time is carved out at each educational level.

In Connecticut's Meriden School District, teachers are provided time for multiple conferences during which they discuss student data and project plans.

School and District Support for Personalized Learning

Advances in personalized learning options—particularly in the technologies and tools to support personalized learning—are rapidly moving forward as support for personalized learning similarly increases. Teachers can now use many targeted technology tools and data collection options that are specific to various aspects of learning for different students across subjects and developmental levels (Digital Promise 2016). To do this successfully, they need support from school and district leaders.

School and district leaders can support data-informed personalized learning by

- restructuring learning environments to provide teachers with access to data;
- arranging schedules to allow teachers time in the day to reflect upon data and plan for their use;
- investing in training, coaching, and continuing professional development for teachers;
- providing opportunities for informal collaboration to share best practices across teachers and buildings;
- designing staffing models that support a flexible learning environment;
- creating an environment where teachers are supported as they create and tailor instruction to individual learners;
- providing and maintaining the technology needed for personalized learning;
- investing in infrastructure, such as updated data systems and high-quality tools; and
- engaging teachers, parents, and the community in discussions of the value of data-informed instruction.

School and district leaders should ensure that appropriate technology tools, technical infrastructure, and schoolwide and classroom routines are in place to minimize the burden that personalized learning may place on teachers. This includes researching and choosing curricula, learning materials, devices, and other technology (Rhode Island Office of Innovation 2017), and supporting teachers as they provide substantive feedback and formative assessment.

State Support for Personalized Learning

Beyond the support needed from school and district leaders, state leaders can also provide critical support for personalized learning. Data systems, though necessary, are not enough (Data Quality Campaign 2016): effective personalized learning plans move beyond using systems to merely collect and manage data to a deliberate focus on using data to engage students and facilitate their progress toward goals.

CCSSO's Innovation Lab Network (https://www.ccsso.org/resource-library/innovation-lab-network-iln) supports a network of states that are working on various student-centered approaches, including personalized learning.

States can also offer more direct support of schools and teachers as they move into and maintain personalized learning efforts. The Rhode Island Office of Innovation (2017) offers several suggestions for state leaders, including these:

- Clarify and provide guidance regarding state regulations that may affect personalized learning plans.
- Develop funding streams to support the technology needed for personalized learning.
- Consider how (and whether) teacher preparation institutions are addressing personalized learning.
- Make relevant and useful resources about personalized learning available to districts, schools, and teachers.
- Dedicate the human capital resources needed to ensure that state leaders are knowledgeable about and can support personalized learning efforts.
- Track statewide personalized learning outcomes.

Develop and Sustain Key Relationships

The development of effective and supportive relationships among stakeholders is also critical to the success of personalized learning. Clear communication among teachers, administrators, students, parents, and the community allows all parties to understand the goals of the plan, as well as the expected roles of different individuals. Teachers

Keeping Parents Informed

In Connecticut's Meriden School District, parents learn about their children's opportunities for personalized learning projects during open houses and parents' nights, and receive additional information about their children's efforts via conversations with teachers and mailings from the school.

need to know that they will have the resources and training to effectively engage students and provide them with meaningful learning opportunities. Students need to understand the philosophies behind personalized learning and know that their personal investment is distinctly tied to the usefulness of the endeavor for their learning. Parents need to understand the ways in which their children will be engaging academically, and how and why the practices and activities their children may experience will be different from what they themselves may have experienced as students. Members of the community who may be involved with various school activities—particularly those who are specifically supporting personalized learning tasks either inside or outside of the classroom—should know about the plans and activities related to personalized learning and how they can best provide assistance to students and academic staff.

Relationships with Stakeholders

Team Yellowstone, at Bozeman, Montana's Sacajawea Middle School, has built stakeholder relationships with parents by involving them in student activities such as drama performances and camping trips. They have also brought in the larger community as stakeholders by having their students create informational texts for local elementary students to create learning partnerships across grade levels.

Technology and data systems facilitate many of the functions of personalized learning, but they are not the only components of successful personalized learning implementation. Similarly, support is needed from the different educational and administrative levels involved in meeting student needs and overall learning initiatives. However, this support from each independent level is not sufficient on its own; also critical to successful implementation is the establishment of effective *relationships* among stakeholders.

The knowledge and understanding that teachers have of their students' learning goals and progress, as well as the supportive relationships they create with students, form the foundation of effective personalized learning. Teachers should create a classroom environment that is flexible and responsive, select high-quality content, work closely with students as they progress through the material, and adapt content when needed (Rhode Island Office of Innovation 2017). Students need to be able to trust in their teachers' abilities to meet these demands.

Prioritizing Stakeholder Relationships

In Vermont, a personalized learning working group discusses relevant issues, offers guidance, and develops resources. This group is made up of a range of stakeholders, including students, teachers, school counselors, principals, superintendents, and higher education representatives.

Beyond this foundation of student-teacher relationships, it is important to facilitate communication and trust among school leaders, district administrators, and state legislators in the pursuit of personalized learning goals. Personalized learning data should be viewed as a means to empower students and teachers by fostering improvement and helping teachers meet student needs. Across different groups of stakeholders, there can be varied coordinated efforts, such as these:

- Teachers collaborate with other teachers in personalized learning efforts and engage with school leaders about successes and challenges (Bill & Melinda Gates Foundation 2015).
- Data teams meet regularly to analyze student data and ensure that the tools and technology provided for personalized learning are meeting individual needs (Johns and Wolking n.d.).
- District and school leaders work with parents and the community to explain the value of data-informed instruction and how student information is protected (Bill & Melinda Gates Foundation 2015).
- State leaders develop the necessary funding streams to fulfill the personalized learning needs of districts and schools, and help schools understand how they can deliver personalized models within existing state regulations (Rhode Island Office of Innovation 2017).

Communicate With Stakeholders

Personalized learning data are often reported not just to the teacher and student, but also to others such as parents, administrators, or district staff. In all cases, data need to be tailored to users and their purposes (Data Quality Campaign 2016). Parents need to understand their children's progress toward content understanding and learning goals, and may also use data to gain a better understanding of the nature of their children's personalized learning. (This is especially true if the parents are only familiar with more traditional educational experiences, such as A-F based grading systems.) School administrators need data to assess the success of different educational efforts, to make decisions regarding allocation of resources, and to determine staffing levels. For example, data that lead a teacher to utilize small instructional groupings may influence the way a principal assigns teachers' aides to classrooms. At the district level, data drawn from personalized learning assessments may indicate progress toward badging systems or content certifications. Across all of these individuals and levels, personalized learning data allow communication and decisionmaking about learning goals and educational progress.

Maximizing Existing Communication

Vermont will be including information about flexible pathways and personalized learning as components of the state's Education Quality Review snapshot and State Report Card, thus utilizing these existing mechanisms to share personalized learning data with parents and the public.

When communicating personalized learning data, school, district, and state leaders need to consider the particular stakeholder group and craft the message in a way that highlights the data most important to that group. Additionally, they should present the data in ways that will be comprehensible and accessible to particular stakeholders.

Personalized learning data shared with stakeholders might include

- expectations for personalized learning and how they will be met;
- progress toward established expectations;
- examples of formative data collected and how they influence classroom practice; and
- comparison data from before and after the transition to personalized learning.

Checklist of Strategies to Support Personalized Learning

- ✓ Create a strategic plan.
- ✓ Modify infrastructure and learning environments to support personalized learning.
- ✓ Plan for the sustainability of personalized learning.
- ✓ Ensure the privacy of personalized learning data.
- ✓ Develop and maintain support structures.
- ✓ Develop and sustain key relationships.
- ✓ Communicate with stakeholders.

Issue in Focus: Moving Beyond Individual Classrooms to Systemwide Personalized Learning

A report from Rhode Island's Office of Innovation (2017) suggests that personalized learning is a shift in the way we educate students, and that moving from individual teachers' efforts to systemwide personalized learning is new to all involved in education. The authors suggest that to be successful, schools and districts moving to a more comprehensive model of personalized learning should foster a culture that supports these practices, including allowing for discussion and adjustment of ideas, teacher development, and leadership capacity. In addition, the shift to personalized learning should be well considered and deliberate, with a solid and clear change management process in place. Ultimately, transforming a school or overall district to this type of student focus requires a culture change (Data Quality Campaign 2016). Vermont, for example, has incorporated personalized learning into its overall efforts to grow a culture of data quality and use; it is seen as a key part of the state's efforts to provide equal access to high-quality educational opportunities for students across the state. Similarly, leaders in Ohio's Mason City School District have described a goal of creating and sustaining a culture of learning for their students, staff, and administrators, focusing on individual student development and partnerships with families and the larger community. In many districts and states across the country, education leaders are considering shifts in focus and activities that allow a more innovative, student-centered perspective and culture.

Chapter 5: Case Studies From States and Districts

The case studies in this chapter are intended to highlight various experiences of states, districts, and schools that have implemented or are transitioning to personalized learning, with a particular focus on how they are managing and using personalized learning data to support, monitor, or evaluate the process.

Just as definitions of personalized learning vary, the methods and priorities of the education agencies featured in this chapter differ in multiple ways and are based on each location's needs and goals. Additionally, it should be noted that all of the examples provided here are still developing.[2]

In addition to the case studies described in this chapter, several districts and schools are highlighted throughout the document. Meriden Public Schools, in Connecticut, is featured in several chapters. Of the 12 schools in the district, the two high schools in Meriden use personalized learning. These two schools have an approximate enrollment of 2160 students, with 75.9% receiving free or reduced-price lunch. Grades 9-12 use personalized learning. Team Yellowstone, a school within a school at Sacajawea Middle School in Bozeman Public Schools (MT) is also featured throughout the document. Sacajawea serves approximately 800 students, with 60 students attending the school within a school.

Westminster Public Schools (Colorado)

Demographic Information

Approximate enrollment: 10,000
Number of schools: 20
Free and reduced-price lunch: 79.0%
Grades using personalized learning: PreK-12
https://www.westminsterpublicschools.org/

Westminster Public Schools (WPS) is the largest school district in the country to be entirely competency based from preschool through high school. WPS officially began its current competency-based personalized learning initiative in the 2009-10 school year, but this effort followed multiple earlier steps toward competency-based learning. Colorado first adopted standards in 1993, which gave students a common set of goals for each subject area and initiated district plans toward competency-based assessment. However, at that time, the available technology systems were not advanced enough to support the data load necessary for competency-based education. In 2007, a board member's visit to a state school board association meeting, which featured discussions on the implementation of standards-based education, led to new consideration of personalized learning at the district level. The district[3] began with a one-year pilot at a single elementary school while developing a communication and implementation plan for all stakeholders. After this one-year pilot, the

[2] Also note that the demographic information provided in each example is for the overall district or state. Not all students in each location are necessarily involved in personalized learning plans.

[3] The district was at that time named Adams County School District 50.

district began the overall effort with the elementary and middle schools, and then moved up a year at a time, in specific subjects, through the high school level.

WPS's competency-based personalized learning efforts cross all subjects and grade levels, and are demonstrated in classroom instruction and activities, such as real-time regrouping of students based on student data and students progressing to the next performance level at any point during the school year. Students are aware of and engaged in the data process through goal setting and recording progress through either hardcopy data notebooks or online versions that are ultimately aligned to career aspirations and goals. Students move through different subjects at the level necessary for them to master the material. The schools have "leveling-up" assemblies as students achieve mastery in given performance levels for any subject. District leaders note that one of the key elements for successful competency-based personalized learning is actively developing student agency, such that students own their learning and are invested in the process. District leaders have concluded that it is essential that teachers have high-quality and effective ongoing professional development that teaches them to empower students.

As the district transitioned to competency-based personalized learning, they found that students at the high school level needed foundations and concepts courses in order to shore up their learning and move successfully into new ways of learning and assessment. Now that the initiative has matured, the foundation courses are no longer necessary, and the number of concept courses are greatly reduced.

Because personalized learning is a districtwide effort in WPS for all school levels, funding for the initiative is not seen as a separate entity, but instead the basis of the overall budget. Funding is directed where it is needed in the system (based on the outcomes of the continuous improvement processes), whether for technology and data systems, classroom support, or professional development. The district looks at funding for competency-based personalized learning not as one large amount to be spent at a single time, but as having funds available to allocate when and where they are needed. As they look to the future, their goal is to avoid overburdening the system by making too many adjustments and recognizing that schools will go at different paces and that the capacity to implement change needs to be effectively managed.

In retrospect, district leaders acknowledge that their incremental path to competency-based personalized learning led to various challenges. As the initiative expanded, high school students in particular moved between one system and the other, which caused confusion for students, parents, and teachers. Within the high school level, the district began by introducing competency-based personalized learning in math, literacy, science, and social studies courses, but the different means of assessing students (based on whether the teachers did or did not incorporate these methods) meant that two types of student report cards were needed—one for core subjects and another for electives. Additionally, families faced different assessment and grading systems for children at different grade levels: one sibling might be doing personalized learning while another was still under a traditional model. These variations made it hard for parents to understand and commit to the new way of doing things during the initial implementation stages.

Because of these challenges, leaders from WPS advise other educational agencies to plan for a full-system model from PreK-12 and get commitment across all stakeholder groups before moving forward. The full shared vision is needed prior to implementation, with communication and understanding of overall goals from teachers, parents, and students. All parties should be involved, with significant emphasis placed on ongoing professional development and well-structured and supported professional learning communities. If an incremental implementation is needed, they

recommend introducing different elements of personalized learning in layers, rather than moving by grade level. They suggest, for example, that a district could move to competency-based standards in year one, establish proficiency scales in year two, and introduce the recording and reporting system in year three. To help other schools and districts transition to a personalized, competency-based system, WPS hosts site visits and an annual summit.

Working With Personalized Learning Data

WPS describes its competency-based personalized learning data process as active, as opposed to the passive "rear mirror" view of data usage in traditional educational models. Data are collected and used in real time, allowing students to know where they stand in relation to different learning targets for each subject area, as well as allowing teachers to regularly group and regroup students based on their mastery. This creates a process that is akin to response to intervention (RTI) or multi-tiered systems of support (MTSS) models, wherein schools can have regular assessment of students potentially falling through the cracks, and teachers can determine what interventions or extensions may be needed. District leaders state that this type of data use requires a heavier data burden for teachers, especially when dynamic recording and reporting systems are used. Leaders stress that strong ongoing professional development is needed to make sure teachers are well prepared for both the academic as well as noncognitive skill development.

Student progress is recorded on a four-point scale, where a 3 is considered competency (this means that a 3 is also akin to an A; a 4 in WPS is seen as a much higher level of rigor than it would be in a more traditional 4-point system). This system does not translate equivalently with all systems across the state, which can lead to issues with student transfers and scholarship programs that are based on traditional grades. This is becoming less of a challenge as more schools and districts begin to utilize competency-based approaches.

District schools use two data systems: a student information system (SIS) that collects overall demographic and attendance data and allows state reporting, and a competency-based learning management system (LMS) that provides student data directly aligned to competencies while allowing assessment and the reporting of student progress. The LMS allows student data to exist across all the years a student is enrolled in the district and for all content areas, rather than only a single school year, so that the data evaluation can be student centric rather than course centric.

At the school level, classroom data are reported in three-week cycles and reviewed by principals. Principals meet regularly with the superintendent, discussing school-level summative data to determine how the data align with the goals and action steps of the school improvement plans. Administrators also engage in monthly "learning walks" at the district level and discuss factors that are either impeding or accelerating the progress of the system. Annually, principals directly and publicly report their schools' data journey to the Board of Education, which is fully invested in Westminster's Learning Model (see https://www.westminsterpublicschools.org/Page/10746).

District leaders note that they have had challenges aligning the competency-based system with state reporting requirements because establishing typical teacher-student data links is more difficult under personalized learning systems. State reporting requires student scores to be attached to particular teachers for the duration of a school year, which is not how assessment works within their competency-based systems. When students "level up" in the competency system, they may stay with the same teacher or move to a different teacher. Additionally, multiple teachers may work with students to address learning gaps or areas of promise identified by student data. Ultimately, it is difficult for the district to fit its data into the current traditional data "buckets" prescribed by the state.

Forest Hills School District (Ohio)

Forest Hills School District (FHSD) began its transition to personalized learning during the design of its 5-year strategic plan. Upon the arrival of a new superintendent in 2014, the district began a process of surveying stakeholders and examining potential ways to better prepare their students for post-graduation success. With a focus on empowering each student to achieve personal academic success, FHSD began a shift to personalized learning as a core element of the strategic plan.

Demographic Information

Approximate enrollment: 7,450
Number of schools: 9
Free and reduced-price lunch: 10.4%
Grades using personalized learning: K-12

The district first focused on transforming the learning experiences of teachers, focusing their professional development on various aspects of personalized learning and giving them opportunities to develop plans to align learning experiences with student needs. Gathering knowledge and support from a varied group of personalized learning experts, district leaders developed a districtwide shared curriculum with new standards incorporating what they call the "6 Cs": collaboration, creativity, critical thinking, communication, citizenship, and character. Teachers have been encouraged to explore ways in which students meet those standards to provide a more personalized learning experience for each student. As district leaders have studied innovative teaching and learning practices, they have simultaneously tried to model effective practices, offer unique pathways, and support collaboration opportunities for educators. These have included "anytime/anywhere" learning opportunities, job-embedded professional learning, and conference style/project-based professional learning.

The district has placed great importance on collaboration among instructional staff. Weekly collaborative time has been established for all teachers in the district to work together to develop creative and effective ways to move from a teacher-centered to a student-centered classroom. Instructional coaches work with teachers to implement strategies such as blended learning, problem-based learning, flipped classrooms, and balanced assessments for mastery.

In their collaborative teams, teachers work to consistently return to four key questions:

- What do we want students to know and be able to do?
- What is the evidence/how will we know when they have learned it?
- How do we respond when students don't learn?
- How do we extend and enrich learning for students?

Working With Personalized Learning Data

FHSD has been transitioning to personalized learning while concurrently developing common assessments. District leaders built a framework for a balanced assessment system with both internal and external assessments, and the assessment system is still a work in progress. After exploring item banks, assessment tools, and products, they have found value in creating their own assessment items.

District leaders note that they have not yet built mastery levels, but they will move to "a more mastery-based conversation" over time. At this point, they maintain a greater focus on helping teachers identify what students need to

know and be able to do in a personalized learning program, and establishing success criteria to show clear evidence of learning.

The district uses a data warehouse and multiple spreadsheets to monitor and track student learning. District leaders acknowledge that this system is not as flexible and dynamic as it should be, and expect that it will need to improve in order to allow teachers to be efficient and effective when dealing with personalized learning data. When asked about data flows between districts and the state agency in Ohio, they noted that to be effective, their statewide data management system would need to be designed to meet the real-time data needs of teachers, as well as to handle both big-picture data of a grade level or district and standardized data for the state. They asserted that many districts are challenged by the issues with the current system, which require additional staff efforts.

Mason City School District (Ohio)

Demographic Information

Approximate enrollment: 10,600
Number of schools: 5
Free and reduced-price lunch: 8.3%
Grades using personalized learning: PreK-12

Mason City School District (MCSD) is working with several options for students and teachers as they develop strategies for personalized learning and continue transitioning from more traditional educational models toward a broad personalized learning approach. District leaders emphasize the importance of growing "the next generation of engaged citizens, problem-solvers and leaders" and feel a responsibility to encourage students to embrace a culture of healthy risk taking as they assume a bigger role in driving their own learning. One of the first changes was to add Personal Learning Days to the school calendar. On these days, students have the opportunity to create and embark upon personalized interest projects outside of school. These may include service learning, global awareness projects, online collaboration, and many other diverse opportunities that are often difficult to fit into the district's current curriculum. In their first year of Personal Learning Days, students designed activities such as field trips to specialized science labs, job shadowing days with doctors and business leaders, environmental sustainability projects, and specialized volunteer opportunities.

Leaders have also been working to engage teachers in personalizing their own learning and to expand their creative possibilities. Designating Personal Learning Days for students created additional time for teacher collaboration and professional development. District leaders have worked with teaching staff to establish and discuss why personalized learning is important, to help them understand that they should view it as a continuum, and to consider creative ways to allow students to customize their education. Building on conversations with multiple experts in personalized learning, the district is continuing to expand teachers' understanding of and comfort with the concept, with a plan to move toward a more expansive personalized learning perspective that includes five key elements.

The first key element is a learner profile that is created by learners, to support the learning process, development of student voice, and self-discovery. The student is the steward of the learning profile. Serving as a collection of information used to personalize learning, the profile includes the learning drivers, strengths, and challenges, as well as evidence of learning and growth inside and outside of the classroom. The second key element is the learning environment, which includes the space-time continuum for learning. It aligns virtual and physical spaces, time for learning, and groupings of learners to maximize progress toward learner outcomes. The third element is learner relationships, which provide the foundation for a positive, inclusive, and engaged learning culture. In personalized learning, the goal is to develop

expert learners who are empowered to know themselves well, advocate for their needs, and drive their own learning throughout life. These relationships reflect trust and respect for who students are as learners and as people. The fourth element is learning paths, which are an opportunity for all students to collaborate with teachers and other key members of their network to co-design meaningful, authentic, rigorous, and relevant learning experiences. Finally, the fifth key element is learner outcomes, which are the clear, compelling goals for learning that include the following:

- **Skills:** Cross-disciplinary outcomes for critical thinking, collaboration, communication, and creativity
- **Mindsets:** Attitudes or beliefs that impact learning, including optimism, flexibility, resilience, persistence, and empathy
- **Content Standards:** Subject-area goals

Working With Personalized Learning Data

Because MCSD is in the beginning stages of its personalized learning efforts, its educators are still considering how data will most effectively be collected and used by teachers, schools, and district leaders. They are working on determining a measurement that shows not only academic progress but also elements such as engagement and behavior growth. The district currently uses standards-based grading, building on a mastery framework in grades K-5. At this time, district leaders are researching options and working with teachers to transition mindsets, gain insights, and co-create MCSD's progress-monitoring system, as they transition into broader personalized learning activities. The district has yet to define its metrics for measuring personalized learning.

Information from the students' Personal Learning Days is not logged into the district's SIS in any formal way (though teachers may document some data related to student reflections). The district's learning management system (LMS) is currently used to inform parents of their children's progress, which is currently based on more traditional academic measures. District leaders state that they would ultimately like to measure data on the "entire student" and his or her experiences, which would include mental wellness, engagement, "difference maker" attributes, academics, projects, and service transcripts.

MCSD currently provides an intranet portal, called MasonConnects, to staff and students that pulls relevant information from the existing SIS. Starting in January 2019, through a development partnership, MCSD will co-develop a system for students to create a robust and fluid learner profile allowing teachers and support staff to better understand the students they serve. Most importantly, the learner profile provides an opportunity for students to reflect upon themselves as learners, one of the five elements of personalized learning. Lastly, MasonConnects aggregates assessment data and offers personalized professional learning, another key factor involved in moving toward personalized learning in the classroom.

Westside School District (Nebraska)

Westside Community School District's (WCSD) transition to personalized learning began as part of its larger strategic plan. In the spring of 2014, the district's strategic planning included a vision statement that called for concepts such as innovative educational ideals, personalized learning, and ensuring a broader, richer definition of success. These concepts were drawn, in part,

Demographic Information

Approximate enrollment: 6,000
Number of schools: 13
Free and reduced-price lunch: 31.3%
Grades using personalized learning: K-12

by focus groups conducted during the strategic planning process, who asked that the district work to customize learning for each student. The district teams involved in the planning of the effort were committed to putting the learner at the center of the learning experiences.

Like many education agencies, WCSD faced the challenge of defining personalized learning and what it should mean in the context of the district. Planning teams researched the topic and ultimately tried to synthesize the information gathered from different sources to develop a plan that worked best for the district's students. The district began the implementation using what they called a "slow roll." They began by identifying a group of "Personalized Learning Early Adopters," who would learn about personalized learning, try new strategies in the classroom, and then share their experiences with other teachers in their professional learning communities. Teacher representatives from each of the districts' ten elementary schools, one middle school, one high school, and one alternative school sent multiple representatives to various trainings that were spread out over the course of the school year. Professional learning for these teachers included developing lessons and curricular units, meeting to discuss and share how these lessons and units worked in the classroom, and then returning to the classroom to implement modified plans based on the discussions with their peers. The district has focused the development of and transition to personalized learning on a philosophy of "student-centered learning by doing." District leaders plan to continue to move new groups through the professional learning and implementation process each year, allowing an organic change movement to occur across the district.

WCSD has also received guidance in its process from consultants from personalized learning organizations and a popular personalized learning textbook. This guidance, as well as the strong leadership from district- and school-level leaders, has allowed the district to work through initial teacher confusion about personalized learning and how it fits into existing teaching and assessment models.

Working With Personalized Learning Data

Because WCSD is still developing and expanding its personalized learning efforts, it is not collecting specific personalized learning data at the district level; the main collection that relates to these efforts is the annual strategic plan survey. In classrooms, teachers collect data and conduct observations related to the five key elements of personalized learning defined by the district and its leaders: knowing your learners; flexible groups, space, and mindsets; voice and choice; data-informed; and technology support. Within the data-informed element, teachers use student learning information to make specific decisions about student growth related to instructional standards. Beyond this, student progress is assessed as it was prior to the transition to personalized learning. In future school years, various teacher and administrator leaders in the personalized learning movement have partnered with educators from partner districts around the country to begin action research that is classroom focused.

Data related to the five key elements that are collected are not entered into the district's SIS. The district is currently experimenting with creating a personalized learning plan through its digital learning platform, and has considered the possibility of having data prepopulate the desired fields once this is established.

Vermont Public Schools

In Vermont, state law and state board of education rules require that, in grade 7 and beyond, students have personalized learning plans (PLPs) and access to flexible pathways for learning. PreK-6 schools are not required to offer personalized learning, but it is encouraged. State statutes include requirements for access to specific pathways, including Dual Enrollment, Career and Technical Education, and Early College.

Demographic Information

Approximate enrollment: 88,428
Number of schools: 313
Free and reduced-price lunch: 41.02%
Grades using personalized learning: 7-12

Number of schools: https://education.vermont.gov/data-finance-budget-book-2019
Enrollment/FRL: Vermont Agency of Education. (2018). *Child Nutrition Programs: Annual Statistical Report.*

State leaders describe a long history of educational innovation in Vermont, which has culminated in recent years in the Flexible Pathways Initiative (http://education.vermont.gov/student-learning/flexible-pathways) and the Education Quality Standards. These initiatives have three overall goals:

- All Vermont children are afforded educational opportunities that are substantially equal in quality.
- All Vermont students graduate from secondary school.
- All Vermont graduates are career and college ready.

Vermont is a local control state (wherein most decisionmaking power is at the district level), but the state education authority is also highly supportive of districts' personalized learning efforts and is working to provide guidance and resources to help them meet instructional and data requirements. In particular, state leaders are trying to ensure a coherent and equitable approach to education and personalized learning through alignment among state legislation (e.g., Act 77), the new Education Quality Standards, and the state's Every Student Succeeds Act (ESSA) plan. The state convened a PLP working group to develop a series of resources and guidelines to assist districts in the implementation of the personalized learning planning process (https://education.vermont.gov/student-learning/personalized-learning/personalized-learning-planning-process) and the state's Proficiency-Based Graduation Requirements (https://education.vermont.gov/student-learning/proficiency-based-learning/proficiency-based-graduation-requirements). This group was comprised of many stakeholders, including students, teachers, school counselors, principals, superintendents, and representatives from higher education.

Working With Personalized Learning Data

State leaders are in the process of establishing Vermont's approach to the collection and use of personalized learning data. In collaboration with stakeholders, they are developing criteria for measuring the degree of personalized learning implemented, as well as the type and quality of personalized learning. The state's ESSA plan includes criteria for the implementation of personalized learning.

In regard to measurement of student progress, the state has provided guidance to districts that they must provide evidence that they are meeting performance-based graduation requirements (defined at the district level), that student progress is being monitored through PLP reviews, and that schools are identifying the learning targets that students must meet as they progress toward proficiency. It also provides guidance surrounding data collection. Though the state does not dictate the means by which personalized learning data are housed and used at the school level, it provides collection

mechanisms and guidance for reporting the data required by the Vermont Education Quality Standards and the ESSA state plan.

Additionally, the state provides technical guidance to assist districts, which can include things such as sample templates and activities to assist educators in their daily practice. It also provides training around both personalized and proficiency-based learning through its professional learning network.

Vermont is in transition in regard to which data are incorporated into its SLDS. As part of the state's ESSA plan and its school climate measures, it will be including measures of students' engagement and role in the development of their PLPs. As part of the College and Career Readiness elements of students' PLPs, the state is collecting Dual Enrollment data as well as Early College participation. In addition, students' participation in Career Technical Education and the High School Completion Program will eventually be included in the ESSA State Report Card and statewide longitudinal data system (SLDS).

At present, the state collects student transcript data via the Student Educator Course Transcript (SECT) collection, which will soon be incorporated into the automated reporting system via the SLDS. These data make the linkage between students, the courses they take, the educators who teach them, and the grades those students earn. State leaders explain that like the current SECT collection, these data will have to conform to specifications that their school/district SIS systems will have to meet in order to be automatically reported in the SLDS environment. Specifications are due for release in 2018.

Utah Public Schools

Demographic Information

Approximate enrollment: 647,870
Number of schools: 1,050
Free and reduced-price lunch: 29.0%
Grades using personalized learning: K-12

In 2012, the Utah legislature passed a law called the Student Achievement Backpack, which allows data exchanges between districts. This went hand in hand with a move to competency-based education (Utah generally uses the term "competency-based" rather than "personalized learning"). Competency-based education in the state is best reflected in its Competency-Based Learning Exploratory Pilot, which includes 13 charter school and district grantees. Utah's state definition for "competency education" (articulated in the Utah Code) is the iNACOL definition (https://www.inacol.org/news/what-is-competency-education/). The Competency-Based Education Grants Program consists of grants to improve educational outcomes in public schools by advancing student mastery of concepts and skills through five core principles: (1) student advancement upon mastery of a concept or skill; (2) competencies that include explicit, measurable, and transferable learning objectives that empower a student; (3) assessment that is meaningful and provides a positive learning experience for a student; (4) timely, differentiated support based on a student's individual learning needs; and (5) learning outcomes that emphasize competencies that include application and creation of knowledge along with the development of important skills and dispositions. Early implementers have taken various approaches in instructional practices as well as data collection and use.

Notably, Utah differs in its approach, as compared to many other states, in that personalized learning is the way in which districts are implementing digital teaching and learning: that is, the data and technology initiatives are driving the educational approaches, rather than the other way around. Whereas many states or districts decide to implement

personalized learning and then figure out data processes and regulations, Utah is allowing districts in the qualified grant program to determine how their instruction can be structured to meet the data requirements of their technological approaches.

At the junior high level, the state has relaxed rules on course requirements: rather than requiring students to take specific courses, students can take types of courses (e.g., a set number of math credits). This allows districts more flexibility in what to offer and returns a level of local control. Some districts see this flexibility as opening up opportunities for student choice, but others have maintained their traditional course requirements.

Working With Personalized Learning Data

Districts participating in the Competency-Based Learning Exploratory Digital Teaching and Learning pilot vary in how they approach competency-based personalized learning data. Some have made changes to their assessment models and data systems in order to use standards- and domain-based competencies: for example, using a mastery scale of 1-4 to represent student progress. Other districts use a mastery system, but translate the 1-4 competency levels to letter grades for student transcripts. While this can make data more transferable or comprehensible to various stakeholders, it goes against effective implementation of the concepts of competency-based learning.

However, those districts working with the mastery levels have experienced challenges in transferring data to other districts. If a student transfers from a "mastery district" to one using traditional letter grades, it can be difficult to use transcripts to determine accurate placement into courses in the new district. Districts try to establish equivalency between courses, but these fundamentally different assessment approaches can cause difficulties. Districts may decide to assume, for example, that a mastery rating of 4 equals an A grade, but the differences in intent of these two types of assessment mean that this is not necessarily the case. To put it another way, a mastery rating of 1 would not mean a student is seen as an "F student" in a personalized learning system—it would simply mean that the student has not yet mastered the material, and that the learning plan should be adjusted such that the student has the time and necessary support to do so. At this time, state leaders are still working on how to aid districts in these types of communications, especially as more districts apply for Competency-Based Learning Exploratory Pilot grants.

Idaho Public Schools

Personalized learning efforts in Idaho currently take place through varied programs, at several educational levels. These include the Idaho Digital Learning Academy (IDLA), a mastery badging system called SkillStack (https://skillstack.idaho.gov/), and the Idaho Mastery Education Network.

Demographic Information

Approximate enrollment: 647,870
Number of schools: 1,050
Free and reduced-price lunch: 29.0%
Grades using personalized learning: K-12

The Idaho Digital Learning Academy (IDLA; https://www.idahodigitallearning.org/) was created 15 years ago when superintendents in the state supported the expansion of online learning, but feared the confusion that might be created if districts developed their own systems independently. Instead, IDLA is a state-level entity that brings digital learning to Idaho's students: a particularly important issue in a state where so many students live in rural areas. Its mission is to provide greater opportunities and educational equity to students across the state.

IDLA currently has three main areas focused on mastery-based and personalized learning:

1. Its core business is offering online courses with a certified online teacher: these courses have had 30,000 enrollments within the last year. IDLA officials state that one in four high school students in the state take a course with them each year, with more enrollment in rural areas.
2. It supports districts in their mastery-based instructional efforts. At this point, the team works with about half of the mastery schools in the state.
3. It partners with other states in infrastructure efforts, particularly those focused on establishing a framework for personalized learning that allows portability. Because personalized learning offerings tend to be very systems dependent at this time, it is difficult to transfer concepts and mastery evidence when a student transfers schools or locations.

SkillStack is a mastery-based badging system in which badges indicate levels of mastery of particular content or skills, and can be used to equal university credit or an indication of career and technical education competency levels. The badges are intended to easily communicate an individual's mastery of a particular content area, whether this was gained in an online course, certification program, or college class. The system aims to support students in their education as well as careers: postsecondary institutions and career and technical education entities have worked together to define the meaning of different badges, and they thus indicate the same mastery of content in either arena. Various industries are involved in the project, to ensure that the badges reflect the correct skills.

The Idaho Mastery Education Network (IMEN; https://www.sde.idaho.gov/mastery-ed/) is a consortium of districts focused on competency-based and blended learning. The state department of education selected 19 regionally diverse schools for the pilot program, each of which is developing unique approaches to mastery education. The IDLA currently works with 9 of the 19 IMEN districts.

Working With Personalized Learning Data

The different personalized learning programs in Idaho use data in a variety of ways. For example, in online mathematics courses offered by IDLA, personalization is based on student mastery of content. Students use a tool called EdReady (https://idaho.edready.org/home), which helps them prepare for math aligned to a specific exam or state standard. Once they take a unit pretest, the system identifies the content they need to meet their goals. The system uses questions aligned to educational objectives to determine whether the student has mastered the content. It can then assign work based on missed objectives.

In the SkillStack system, data are used to determine whether a student has mastered the content needed to earn a particular badge. At this point, a teacher must manually provide the evidence that a student has reached a particular mastery level, which currently puts a substantial burden on teachers (particularly on top of their other tasks). However, system designers are working toward a configuration in which students could determine appropriate evidence and submit it, allowing the teacher to simply approve the submitted information. Designers are also working toward a universal record storing function that could offer a universal gradebook. In this arrangement, marking students as competent in one system would carry over to others, thus reducing the burden on individual instructors. Another potential vision is for internship programs or apprenticeship supervisors to have the capacity to certify students for mastery, thus increasing the crossover of the system between secondary/higher education and industry.

Lessons Learned

Though there is great variation in the design, implementation, and maturity of the personalized learning programs summarized in this chapter, the experiences of the stakeholders in the different locations echo many similar challenges and solutions. The list below is a summary of lessons learned by the leaders in these and other education systems:

- Encourage communication among stakeholders and develop specific, intentional means for collaboration.
- Co-create the vision for the personalized learning program.
- Start with a guiding coalition of committed individuals.
- Determine reasonable timelines for change, and leave room for unexpected challenges.
- Consider the types and specific uses of data involved with personalized learning.
- Know that the core elements of personalized learning take time to build. Allow time for ideas to incubate.
- Foster a culture of innovation and encourage creative approaches.
- Consider the goals of and vision for the personalized learning program when determining how to assess its success and impact.

Chapter 6: Issues to Consider

Across the country, some states and districts working with personalized learning have well-established programs that have been in place for several years, while others are just beginning to assess what tools and resources would be needed to implement a plan appropriate to their needs. Some locations have focused their efforts on a particular educational level (e.g., middle school or high school), while some see personalized learning as a means for students to reach their college or career goals. The practicalities of these efforts range considerably as well: some education agencies may see personalized learning as a way for teachers to provide more meaningful classroom learning, while others have focused on digital learning or activities done independently by students outside the classroom. Educators using methods such as Montessori have long espoused the central tenets of recent personalized learning, such as child-directed activities (with teacher guidance), creative learning, and self-directed work. In short, though *personalized learning* is a term used by many educators, it can mean many different things in practice.

The states and districts whose personalized learning plans have been highlighted throughout this resource demonstrate these variations. These plans differ in the nature and scale of their efforts: for example, there are district-level programs, state-supported pilot programs for selected districts, state programs that support personalized postsecondary planning, district programs to support individual learning beyond the classroom, and statewide programs supporting varied endeavors. Across these divergent efforts, however, several key issues have emerged, the consideration of which can guide education leaders toward greater levels of success.

The Challenges of Personalized Learning

The use of personalized learning has been steadily increasing in many areas of the country, but it does not come without challenges. As more states and districts move toward personalized learning, they may face varied challenges in preparation and execution. Some of these challenges are technical, such as inadequate or aging data systems, while others are practical, such as how to transition to new ways of evaluating student achievement.

Data Systems and Staffing

In order to effectively use student data to support personalized learning, schools and districts need to consider as they plan their data systems that personalized learning data may be different and extensive. With the increase of data-informed instruction and expansion of data capacities such as statewide longitudinal data systems, many education agencies are better prepared than ever to handle these requirements. However, some are not yet able to meet the expanded data- and technology-related demands of personalized learning. Data systems may not be sophisticated enough to handle significant amounts of learning analytics data, for example, or systems may not be linked in such a way that data can effectively be shared across classrooms, schools, or districts. This limits the possibility of collaboration across data teams, and may

also be a problem in areas of significant student mobility (Baker 2016). Common data system challenges related to personalized learning that have been identified by states and districts include the following:

- Varied data systems used by different districts within a state can present a challenge for facilitating communication among districts.
- A lack of flexibility in data systems can prevent states and districts from effectively capturing, interpreting, and using personalized data.
- Districts still have reporting responsibilities for outcomes (e.g., grades, course completion, transcripts, teacher effectiveness metrics), and the way these data are reported upward may be affected by the introduction of personalized learning and mastery data.
- Mastery and competency systems designed to connect secondary, postsecondary, and industry entities raise questions about whose responsibility it is to assess mastery and record these data—high school teachers, higher education faculty, or industry representatives.

As education agencies make broad and far-reaching changes in how learning is organized and assessed, they continue to face many questions and challenges of a practical nature.

In Connecticut's Meriden School District, personalized learning coordinators work to align each student's personalized learning experience to state standards. Additionally, a review committee at each high school samples 5 percent of the projects to provide an independent review of their rigor.

Transitioning to a Mastery Perspective

In some cases, personalized learning's typical focus on mastery-based progression has been the source of challenges. In most personalized learning environments, students move to new concepts or objectives when they can demonstrate mastery. This differs from traditional arrangements in which a given learning activity is allotted a certain amount of time (Rhode Island Office of Innovation 2017). Additionally, evaluation of achievement may be different: students are generally deemed as having reached mastery within a given domain, rather than receiving a numeric or letter grade. Because of these differences, schools or districts can have problems transferring meaning about a student's educational progress or achievement to other institutions, whether they are within K-12 or in higher education.

For example, Utah is still establishing how to transfer information about a student if he or she moves from a school using a mastery-based system to one still using traditional grades: the receiving school is not set up to interpret such a differing transcript. Leaders in Ohio's Forest Hills School District note the challenges of "dealing with the ambiguity" of personalized learning and transferring to a student-centered, mastery-based perspective. Additionally, many schools using mastery-based progression have struggled with alignment with state-mandated tests focused on grade-level content (Hyslop and Mead 2015), as well as comprehensible transcripts for college applications. Connecticut's Meriden School District has mediated questions about the academic rigor of personal learning projects and their alignment with traditional curriculum (see text box). At this time, there is minimal research focused on the implementation of competency- or mastery-based instruction (Ryan and Cox 2017), leaving education agencies without a wealth of models or best practices.

Student Assessment and Grades

Many schools and districts find themselves struggling to align issues such as competencies and mastery-based assessment with more traditional educational structures and expectations, such as year-end summative assessments—many of which

focus on grade-level standards or content (Hyslop and Mead 2015). Education agencies that have moved to mastery demonstration, badging systems, or certifications of content knowledge can find it difficult to draw clear parallels to the grading systems and test scores that may be used by other districts or the state; students may also face challenges when applying for colleges or scholarships. In some cases, schools choose to provide a more limited version of mastery-based assessment, or they may try to translate mastery-level data to align with more standard grading systems when sharing data with other locations. A 2015 RAND study indicated that due to various impediments, many schools may implement only some elements of competency-based instruction, such as setting competency thresholds and providing students with appropriate content. Structural components like traditional grade levels and state reporting requirements may keep schools from more complicated elements of mastery-based systems (Pane, Steiner, Baird, and Hamilton 2015). In other cases, schools or districts may hesitate to introduce personalized learning at all.

Continuing Questions

As the popularity of and expectations for personalized learning continue to expand, the transitions occurring in states and districts across the country are nonetheless still works in progress. States and districts have identified many necessary elements for success, but questions remain as personalized learning becomes part of the educational plan in more and more places. Education leaders are still grappling with issues such as these:

- How to meaningfully incorporate technology, rather than assuming that digital learning automatically equals "personalized" learning
- How to engage students who still need more guidance, even when working on individualized tasks
- How to ensure that personalized learning options are equitable across schools or districts with different funding levels
- How to ensure the privacy and security of student data
- How to work within existing laws or regulations to reach desired or mandated goals

As the number and size of personalized learning programs in states and districts continue to grow, education leaders must work with their varied stakeholders to determine the particular needs of their location and students, and think strategically to design and implement plans that will not only allow their students to reach their goals but also be sustainable over an extended period of time. Needs assessments should carefully consider the data elements, tools, and systems required to effectively evaluate information and reach intended goals, as well as what steps must be taken in resource building to ensure that these needs are met. Support systems should be developed such that teachers and students have the resources, training, and assistance to embark upon personalized learning effectively; in particular, teachers need specific training and guidance on collecting and utilizing personalized learning data. Opportunities for collaboration should be built into the design such that teachers and leaders can discuss and use data, as well as share ideas, innovations, and solutions to challenges.

Personalized learning allows new and innovative perspectives on learning, but also requires careful consideration of a myriad of variables. This resource was designed to provide education agencies at various stages of the development process specific practices and areas of consideration that may help them in their endeavors, and allow them to meet the educational needs of diverse students.

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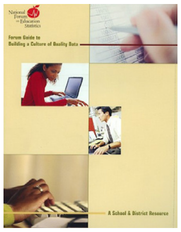
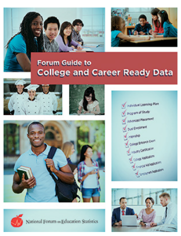
National Forum on Education Statistics Resources

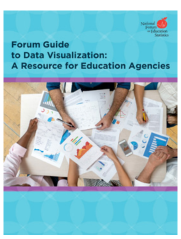


Forum Guide to Building a Culture of Quality Data: A School and District Resource (2004)
https://nces.ed.gov/forum/pub_2005801.asp
This guide shows how quality data can be achieved in a school or district through the collaborative efforts of all staff and offers recommendations to staff in schools and school districts about best practices for improving data quality.

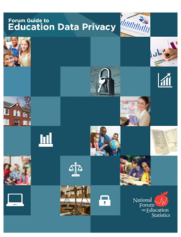
Forum Guide to Collecting and Using Attendance Data (2008)
https://nces.ed.gov/forum/pub_2017007.asp
This guide provides best practice suggestions, real-life examples, a standard set of attendance codes, and role-specific tip sheets to help state and local education agency staff improve their attendance data practices.



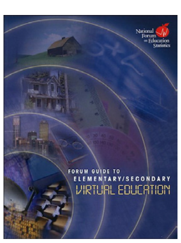
Forum Guide to College and Career Ready Data (2015)
https://nces.ed.gov/forum/pub_2015157.asp
This guide outlines the data needs and helpful analytics for five use cases (individual learning plans, educator support systems, postsecondary feedback loops, accountability systems, and career technical and education programs) that support SEA and LEA college and career ready initiatives.



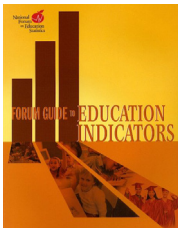
Forum Guide to Data Visualization: A Resource for Education Agencies (2016)
https://nces.ed.gov/forum/pub_2017016.asp
This guide recommends data visualization practices that will help education agencies communicate data meaning in visual formats that are accessible, accurate, and actionable for a wide range of education stakeholders.



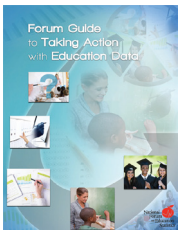
Forum Guide to Education Data Privacy (2016)
https://nces.ed.gov/forum/pub_2016096.asp
This guide was developed as a resource for state and local education agencies (SEAs and LEAs) to use in assisting school staff in protecting the confidentiality of student data in instructional and administrative practices. SEAs and LEAs may also find the guide useful in developing privacy programs and related professional development programs.



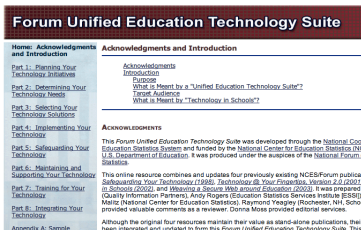
Forum Guide to Elementary/Secondary Virtual Education Data (2016)
https://nces.ed.gov/forum/pub_2016095.asp
This publication provides information on the impact of virtual education on established data elements and methods of data collection and addresses the scope of changes, the rapid pace of new technology development, and the proliferation of resources in virtual education.



Forum Guide to Education Indicators (2005)
https://nces.ed.gov/forum/pub_2005802.asp
This guide provides encyclopedia-type entries for 44 commonly used education indicators. Each indicator entry contains a definition, recommended uses, usage caveats and cautions, related policy questions, data element components, a formula, commonly reported subgroups, and display suggestions.



Forum Guide to Taking Action with Education Data (2012)
https://nces.ed.gov/forum/pub_2013801.asp
This guide provides practical information about the knowledge, skills, and abilities needed to identify, access, interpret, and use data to improve instruction in classrooms and the operation of schools, local education agencies, and state education agencies.



Forum Unified Education Technology Suite (2005)
https://nces.ed.gov/forum/pub_2005_tech_suite.asp
This web resource presents a practical, comprehensive, and tested approach to assessing, acquiring, instituting, managing, securing, and using technology in education settings.

Part 2:

Chapter 1: Introduction to Early Warning Systems

High school graduation rates in the United States have shown steady increases in recent years, reaching a record high in 2014 of 92.4 percent among 18- to 24-year-olds (McFarland, Cui, and Stark 2018). During this same period, over half a million students ages 15-24 left school without obtaining a high school diploma or earning a high school equivalency credential by passing a comprehensive equivalency examination, such as the General Educational Development (GED®) test, Test Assessing Secondary Completion™ (TASC), or HiSET exam. While high school graduation rates have improved over time, the need to support students who are at risk of dropping out of school remains.

There are many important reasons to remain focused on supporting student progression, achievement, and graduation. Timely academic progression and graduation can strongly influence a student's future life outcomes. When compared with individuals with less than a high school diploma, those with at least a high school diploma were more likely to be employed and to have higher median weekly earnings (U.S. Department of Labor 2017). Individuals who drop out of high school are also at risk of poorer health and a shorter lifespan in comparison to those who have graduated (Rouse 2007; Pleis, Ward, and Lucas 2010). Graduating from high school can improve individual outcomes and provide graduates with opportunities that positively impact their lives.

Trends in High School Dropout and Completion Rates in the United States: 2014
https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2018117
This National Center for Education Statistics (NCES) report draws on a wide variety of data sources to examine high school dropout and completion rates, as well as data on long-term trends. This report describes the characteristics of high school dropouts and completers, including race/ethnicity, sex, socioeconomic status, disability status, recency of immigration, and outcomes in the labor force.

In recognition of the critical need to support educational attainment and graduation, many state and local education agencies (SEAs and LEAs) are considering methods and strategies to improve the provision of student interventions, services, and supports. As of the 2014-15 school year, about half of public high schools reported using an early warning system to identify students who are at risk of dropping out of school (U.S. Department of Education 2016). Early warning systems strategically use data to identify students in need of additional support and interventions that will help improve student success. By identifying students as soon as they begin to demonstrate some risk of not completing high school, early warning systems may support the provision of early interventions, which are typically more effective and affordable than late interventions.

Early Warning Systems

An early warning system identifies students who are at risk of dropping out of school. This type of system applies predictive analytics to student data to determine student risk level in relation to predefined indicators and thresholds. Risk factors traditionally include attendance, behavior, and course performance, and may include other factors such as

exhibited behaviors or academic performance. By identifying students who are at-risk, an early warning system provides targeted data that may be used to develop student interventions that are designed to avoid negative student outcomes. Early warning systems are more than just a technology system—they are a tool in the process of identifying and supporting students who are at risk of not achieving their educational goals.

System Scope

The scope of an early warning system is influenced by an education agency's priorities, resources, and policies. Early warning systems may focus on students who are at imminent risk of dropping out, students who are at future risk of dropping out, or both. Agencies may be constrained in whether they can focus on students who are at imminent or lesser and/or future risk. Ideally, an agency would have staff teams who can address the needs of, and design interventions for, both populations.

In addition to identifying students who are at risk of dropping out of school, early warning systems may also identify student risk levels in relation to other outcomes, such as on-time graduation, grade-level assessment thresholds, or specific academic achievement criteria, such as college and career readiness. A student may be considered at risk if, for example, he or she fails a fourth grade reading level assessment, experiences significant declines in grade point average (GPA), or performs poorly on a state graduation exam.

Early warning systems may be used differently at various grade levels. High school early warning systems may assess whether students are at risk of dropping out before the end of the school year, while elementary school systems may instead assess whether students are exhibiting risk factors that indicate they may struggle in high school. Thus, an effective intervention for an elementary school student who is not performing at grade level would be different than an intervention for a high school student who is at risk of dropping out.

While early warning systems identify students who are at-risk, they are not a diagnostic method for identifying the root cause of why a student is exhibiting risk. Further investigation is needed to understand the root causes of student risk and provide targeted interventions that are tailored to each student's unique needs and address the root causes of the risk.

Related Systems

Early warning systems provide information on the level of risk exhibited by students, with the intention that students who exhibit the highest risk of dropping out will receive targeted interventions. Early warning systems are designed to inform student interventions and can support related systems, such as intervention systems, multi-tiered systems of supports (MTSS), and response to intervention (RTI). While some early warning systems work in tandem with these related systems, some do not. For example, a statewide early warning system that provides information on student risk levels would likely not include an intervention system, as SEAs are not typically responsible for implementing local student interventions. However, LEAs can use a statewide early warning system as a source of information to support their implementation of an intervention system at the school or district level.

System Outcomes

Supporting student achievement and success is an essential component of the responsibilities of education agencies at the school, district, state, and federal levels. Early warning systems enable schools, districts, and states to make informed

decisions and direct resources and services to those students who are in need of intervention. SEAs and LEAs can use an early warning system to identify which students are at-risk, determine the extent to which each student is at-risk, and decide whether to initiate a root-cause analysis to determine why each student may be at risk. Accurate, secure, useful, and timely data about the at-risk status of students helps education agencies provide intervention programs and services that support student needs and address the root causes of student risk. This critical insight into student risk provides SEAs and LEAs with actionable information that can guide the development and provision of targeted interventions to reduce dropout risk and promote student progression, achievement, and graduation.

The provision of adequate and appropriate intervention programs and services can improve student outcomes and promote the achievement and success of students who are at risk of dropping out. Successfully using these systems to prevent students from dropping out helps ensure continued system use. Reducing dropout rates may also generate increases to total per-pupil funding, which could, in certain cases, make these systems a good return on investment.

Resource Spotlight: Early Warning Systems

Several agencies and organizations provide resources and technical assistance on early warning systems. SEAs and LEAs may find it useful to consult these resources as they consider developing a new, or refining an existing, early warning system.

Development and Use of Early Warning Systems: SLDS Spotlight
https://nces.grads360.org/#communities/slds-best-practices-conference/publications/2738
This brief was derived from a Statewide Longitudinal Data Systems (SLDS) Grant Program webinar that focused on the development and use of state-level early warning systems in Maine, Massachusetts, and South Carolina. Presenters from each state discussed the benefits and challenges of implementing an early warning system and shared best practices for stakeholder input, planning, validation, training, and data use.

Early Warning Indicators and Segmentation Analysis: A Technical Guide on Data Studies That Inform Dropout Prevention and Recovery
https://files.eric.ed.gov/fulltext/ED577226.pdf
This technical resource walks districts and schools through the early warning system planning, development, and implementation process. The guide details the specific technical steps involved in establishing an early warning system and conducting a segmentation study.

Early Warning Systems in Education
http://www.earlywarningsystems.org
American Institutes for Research (AIR) has developed action-oriented, research-based resources and tools that states, districts, and schools can use to identify students in need of targeted interventions and supports to help student achievement and success. This website offers tools, resources, technical assistance, and training to support the design and implementation of early warning systems.

Early Warning Systems Learning Series
https://ies.ed.gov/ncee/edlabs/projects/ews.asp
The Institute of Education Sciences' Regional Educational Laboratory (REL) Program has developed a series of projects on implementing and using early warning systems for dropout prevention. Resources related to projects in this series include webinar recordings, in-person event materials, videos, tools, infographics, reports, and works in progress. Useful resources include *A Practitioner's Guide to Implementing Early Warning Systems* (Frazelle and Nagel 2015), *Getting Students on Track for Graduation: Impacts of the Early Warning Intervention and Monitoring System After One Year* (Faria et al. 2017), and *Four Signs Your District is Ready for an Early Warning System: A Discussion Guide* (REL Pacific 2016), amongst many more.

Early Warning System Planning Process

Early warning systems require time, money, and effort. A continuous improvement process (figure 1) can help ensure that an early warning system is designed to support agency needs; is used appropriately and effectively in decisionmaking; and is responsive to changes in student populations, data practices, and agency processes. The tasks and activities in this process should be revisited regularly to assess the ongoing relevance and effectiveness of the system, as well as to identify opportunities for improvement.

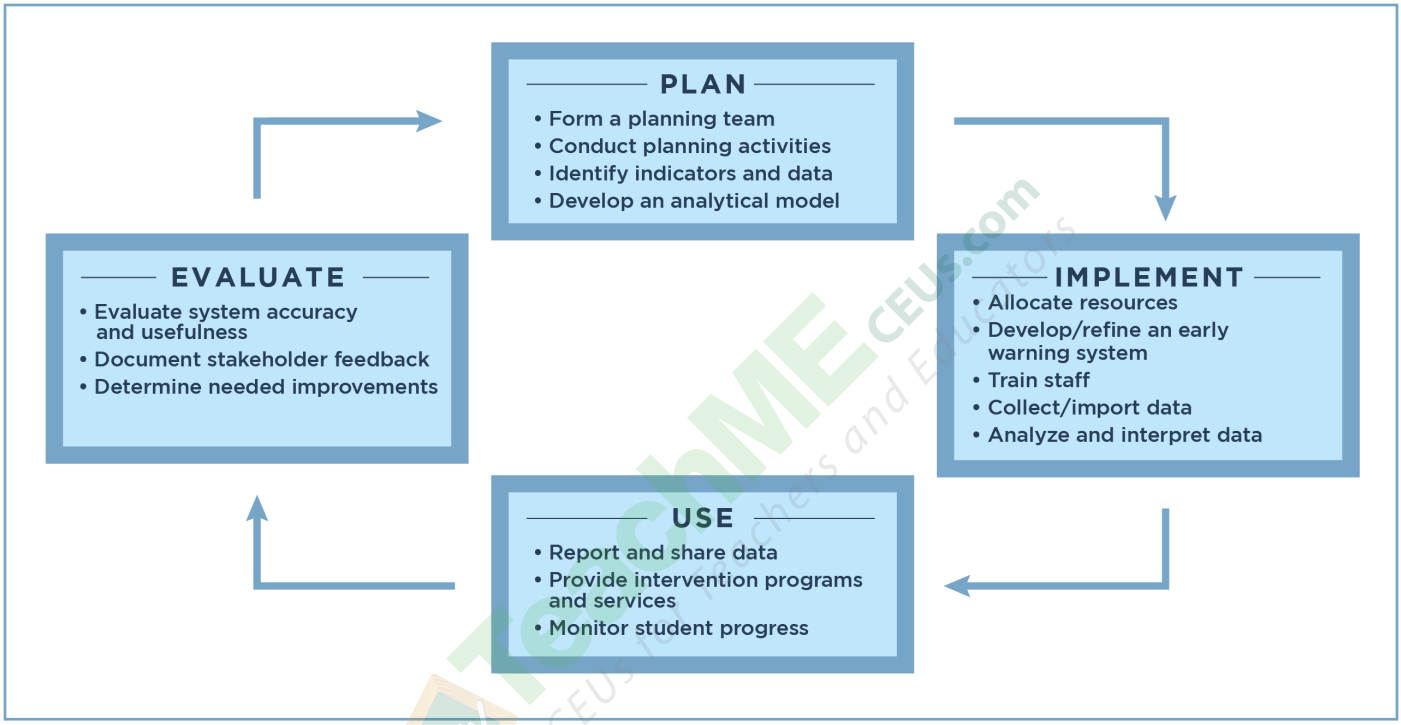


Figure 1. Continuous improvement process for early warning systems

A list of tasks related to planning, implementing, using, and evaluating an early warning system is included in appendix A. Education agencies may find it useful to align the tasks and activities in this process with their organization's needs and operational processes. Consulting resources on early warning systems (such as those listed in the Resource Spotlight textboxes in this guide) during the initial stages of the planning process can help agencies develop a robust approach to system planning and implementation.

Form a Planning Team

The development, implementation, and use of an early warning system require technical and analytical expertise, a broad-based commitment to data use, and an understanding of the agency and its resources. An early warning system planning team can provide the project management oversight necessary for system success.

Early warning system planning, development, implementation, and use involves all aspects of an education agency. A representative planning team can strengthen the planning process and ensure that an early warning system is feasible and sustainable and meets agency and stakeholder needs. An early warning system created without the involvement

An early warning system planning team may include

- agency administrators and leadership;
- policy and research staff;
- data management and technical operations staff;
- student intervention and support staff;
- teachers;
- financial decisionmakers; and
- representatives from other stakeholder groups.

of representative staff and agency stakeholders might not incorporate key information necessary to support agency needs. Agency representatives may include administrators and leadership, policy and research staff, data management and technical operations staff, student intervention and support staff, teachers, and financial decisionmakers.

A diverse and representative planning team can contribute valuable expertise from the perspective of each member's department or program area. However, different parts of the agency may have different goals and objectives for an early warning system. As a first step in the planning process, planning teams can work together to define the purpose of an early warning system and develop goals and objectives for system planning, implementation, and use. This can encourage the planning team to develop consensus and ensure that all members share a common understanding—and contribute towards the advancement—of the system planning process.

Planning Activities

With a planning team in place, the agency can begin creating a plan for implementing and using an early warning system to identify students who are at-risk. Team contributions can be enhanced through clearly defined roles and assigned responsibilities for individual team members.

The planning process may include various activities, such as

- conducting a needs assessment to identify agency and stakeholder needs;
- engaging stakeholders through focus groups, interviews, or public presentations and meetings;
- identifying and validating early warning indicators, data elements, and analytical models;
- evaluating whether a system should be developed in-house by agency staff or procured from an external vendor or organization;
- creating a system development plan or request for proposal that includes goals, timelines, and deliverables;
- determining how end users will access and use the data, and developing a plan to ensure end users are involved in the system design process; and
- developing a budget that includes a cost-benefit analysis and a projection of staff time necessary for system development, implementation, and maintenance.

Questions for Consideration

When forming an early warning system planning team, it is helpful to consider who will be represented on the team, which activities the team will undertake, and how team members will be expected to contribute to the planning process.

- What factors are motivating your agency to consider an early warning system?
- Will the early warning system be created as part of a program, grant, or agency initiative?
- What types of planning activities will your team undertake before developing the early warning system?
  - Conduct a needs analysis.
  - Engage stakeholders.
  - Identify and validate indicators, elements, and analytical models.
  - Evaluate in-house development or vendor purchase options.
  - Create a system development plan.
  - Plan for end-user access.
  - Develop a budget.
- Which staff role(s) will be involved in the early warning system planning process?
  - Administrators
  - Teachers
  - Research staff
  - Data management staff
  - Student intervention and support staff
  - Financial decisionmakers
- Will agency staff create the system, or will your agency work with an external group (e.g., a vendor, consultant, or other education agency) to create the early warning system?
  - If agency staff will create your system, which departments and staff will be responsible for developing, implementing, and maintaining the system?
  - If an external vendor or organization will create your system, which departments and staff will be responsible for overseeing procurement, implementation, and maintenance?

Chapter 2: Early Warning System Indicators, Data, and Analytics

Early warning indicators, data, and analytics enable early warning systems to generate the information needed to identify students who are at risk of dropping out of school. Defining valid early warning indicators, collecting high-quality data, and identifying appropriate analytical techniques prior to system development can ensure that a system is aligned with agency needs, resources, and processes.

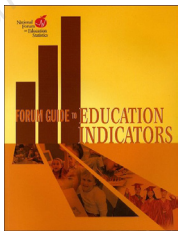
Early Warning Indicators

An education indicator is a measure of the status of, or change in, an educational system with regard to its goals (National Forum on Education Statistics 2005). In the context of an early warning system, early warning indicators measure the extent to which a student is likely to be at risk of dropping out of school.

In determining which indicators to use in an early warning system, it is helpful to consider the following:

- Have research studies found that the indicator is an effective predictor of dropout risk?
- Has the indicator passed local validation tests?
- Are the data needed for the indicator currently collected and readily available, or might it be feasible to implement a new data collection?
- Are the data used in calculating the indicator of high quality?
- Does the indicator improve overall system accuracy?

http://nces.ed.gov/forum/pub_2005802.asp



The purpose of this guide is to help readers better understand how to appropriately develop, apply, and interpret commonly used education indicators. It provides encyclopedia-type entries for 44 commonly used education indicators. Each indicator entry contains a definition, recommended uses, usage caveats and cautions, related policy questions, data element components, a formula, commonly reported subgroups, and display suggestions.

Identify and Define Indicators

To be most effective, indicators and thresholds should be locally validated and applicable to the student population of that school, district, or state, as what is considered an at-risk threshold for students in one locality may not be the same in another locality. Indicator identification may occur through an analysis of preexisting internal longitudinal data that seeks to identify predictive trends and patterns, a review of external research conducted by other education agencies and organizations, or a combination of both internal analysis and external consultation.

State and local education agency (SEA and LEA) planning teams need to determine whether nationally recognized indicators are effective within the context of their school, district, or state. Specific research-based early warning indicators, such as the ABC indicators (attendance, behavior, and course performance) are well established and have been verified through research studies (e.g., Allensworth and Easton 2007; Balfanz, Herzog, and Mac Iver 2007; Mac Iver 2010).

A backward design process, which involves determining outcomes before identifying potential indicators, can be a useful approach for developing early warning indicators. Once the planning team determines which outcomes stakeholders would like their students to attain, student data can be segmented and analyzed based on whether students did, or did not, meet those outcomes to determine what, if any, differences exist between these two groups. The results of a segmentation analysis can guide the development of locally valid early warning indicators and thresholds (Jobs for the Future 2014).

Indicator development is most effective when guided by research and data that demonstrate the appropriateness and accuracy of the indicator's prediction of dropout risk. Determining indicator effectiveness based on individual perceptions may unintentionally bias the accuracy of a system. For example, tardiness may be predictive of whether a student will drop out of school, but absence data may be of higher quality and more effective at predicting dropout risk. Research staff can assist planning teams with indicator identification and validation. If an SEA or LEA does not have researchers on staff, external partners such as academic researchers, Regional Educational Laboratory (REL) program staff, or data consultants could work with the agency to identify and validate indicators.

Commonly Used Early Warning Indicators

Early warning systems commonly include indicators related to the ABCs: attendance, behavior, and course performance (U.S. Department of Education 2016). Some early warning systems, particularly at the state level, include assessment performance indicators and mobility indicators. General student data, such as identification and enrollment data, are not commonly used as indicators but may be included in an early warning system.

Table 1 includes a list of commonly used early warning indicator areas that SEAs and LEAs have used in their early warning systems. The list of indicators is not exhaustive, nor is the accurate identification of student risk contingent on the use of these indicators. SEAs and LEAs may wish to consult the case studies in chapter 4 to learn more about various agencies' early warning systems. A select list of early warning indicator topics, student-level indicators, and related data elements is included in appendix B.

Common Indicators	SEA and LEA Case Studies (Chapter 4)
Assessment performance Achievement or performance on a school, district, and/or state assessment, typically a test	Appoquinimink School District, DE Fairbanks North Star Borough School District, AK Wisconsin Department of Public Instruction
Attendance Attendance in an instructional program approved by the school, district, and/or state[1]	Appoquinimink School District, DE Bozeman School District #7, MT Delaware Department of Education Fairbanks North Star Borough School District, AK Metro Nashville Public Schools, TN Montana Office of Public Instruction Wisconsin Department of Public Instruction
Behavior Negative or inappropriate behavior that results in a disciplinary action	Appoquinimink School District, DE Bozeman School District #7, MT Delaware Department of Education Fairbanks North Star Borough School District, AK Metro Nashville Public Schools, TN Montana Office of Public Instruction Wisconsin Department of Public Instruction
Course performance Academic achievement or performance across all courses or a select set of courses	Appoquinimink School District, DE Bozeman School District #7, MT Delaware Department of Education Fairbanks North Star Borough School District, AK Metro Nashville Public Schools, TN Montana Office of Public Instruction
Mobility Geographic movement between schools, districts, and/or states	Appoquinimink School District, DE Bozeman School District #7, MT Montana Office of Public Instruction Wisconsin Department of Public Instruction
Progression On-time advancement to the next level or grade in an instructional program	Appoquinimink School District, DE Bozeman School District #7, MT Fairbanks North Star Borough School District, AK Montana Office of Public Instruction Wisconsin Department of Public Instruction

[1] For more information, see the *Forum Guide to Collecting and Using Attendance Data* at https://nces.ed.gov/forum/pub_2017007.asp.

Table 1. Commonly used early warning indicators and agencies that use these indicators

Early Warning System Data

The use of a given indicator is predicated on whether the related data are available, valid, and reliable. Data availability is particularly influential in developing statewide early warning indicators since SEAs have fewer student-level data points than LEAs. Reviewing preexisting data collections and mapping data elements to related indicators can help agencies determine whether high-quality data are available for each proposed indicator.

In determining which data to use in an early warning system, it is helpful to consider the following:

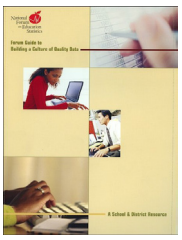
- How many years of data will be used?
- Which data are available?
- Are the data recent?
- Are the data timely?
- Are the data collected regularly to support system predictability?
- What is the quality of the data?

Develop a Culture of Data Quality

The effectiveness of an early warning system is contingent on the quality of the data. Quality data are accurate, secure, useful, and timely (National Forum on Education Statistics 2004). A thorough understanding of the nature of early warning data, agency data collection processes, and system data analysis techniques is essential for validating data quality.

The timeliness of data and, by extension, the frequency of data collection, reporting, and analysis processes is an essential component of system data quality. The definition of "timely data" may differ across agencies. A statewide, SEA-operated early warning system may use the most recent year's annual summative data, while a districtwide, LEA-operated system may be dynamic and update data daily to identify students more readily. This difference impacts the types of action an agency can take based on the data.

https://nces.ed.gov/forum/pub_2005801.asp



The purpose of this guide is to help readers improve the quality of data they collect and to provide processes for developing a "Culture of Quality Data" by focusing on data entry—getting things right at the source. It shows how quality data can be achieved in a school or district through the collaborative efforts of all staff.

When establishing a schedule for data updates, agencies also need to consider the purpose and goals of the system. Frequently updated data may be more accurate in identifying risk status if it is additive; that is, if it is retained by the system and contributes to the system's predictive abilities. Ongoing, systematic data processes enable early warning systems to identify students in need of intervention as soon as they meet a preexisting threshold. Agencies that update their early warning system data frequently and consistently can rapidly identify students who meet thresholds and design interventions for those students, while agencies that update their data only once or twice a year may miss key opportunities to support students in need of interventions. Systems that assess student risk using frequently updated data may be most useful for identifying older students who are at imminent risk of dropping out of high school, whereas a system that identifies elementary school-age students that demonstrate future risk of dropping out may not require real-time data.

Protect Data Privacy and Security

As with any system that contains personally identifiable information, care must be taken to ensure that student data are private and secure. SEAs and LEAs must ensure that early warning system data are protected, secure, and used only for the intended purpose of the system. Numerous laws, including the Family Educational Rights and Privacy Act (FERPA) (20 U.S.C. § 1232g; 34 CFR Part 99), have been enacted at the federal, state, and local levels to protect student information and data. Guidance and legally authoritative resources on protecting student privacy, including publications, training materials, and technical assistance, are available through the U.S. Department of Education's Office of the Chief Privacy Officer website: https://studentprivacy.ed.gov.

https://nces.ed.gov/forum/pub_2016096.asp

This guide is a resource for SEAs and LEAs to use in assisting school staff in protecting the confidentiality of student data in instructional and administrative practices. SEAs and LEAs may also find the guide useful in developing privacy programs and related professional development programs.

Collect Accurate and Timely Data

Data used in early warning systems are often already available as part of other data collections that occur in the school, district, or state. For statewide early warning systems, SEAs may be able to use data already reported by LEAs. For district- and school-level early warning systems, LEAs may be able to use data already collected at the local level or draw on data used in a statewide early warning system. For example, the Appoquinimink School District (DE) uses regularly collected data to update its early warning system each marking period, and thus did not need to implement any new data collections to support the system.

While some data already exist and remain relatively constant over time, other data are generated through one-time or recurring events and activities. Existing data need to be mapped to or aligned with the early warning system before being imported or uploaded, and new data will need to be collected as students progress through school. For example, student identification information often remains constant, grade-level assessment scores may be generated one time, and attendance status data are generated each school calendar day or, in some cases, every class period, depending on how frequently attendance is recorded. In the Irving Independent School District in Texas, historical student attendance data are used to identify students whose attendance will be monitored daily by an attendance administrator charged with intervening to keep the student in school. The *Forum Guide to Collecting and Using Attendance Data* (2018) provides best practice information on the collection, reporting, and use of attendance data in education agencies.

If early warning data are missing, nonstandard, or not regularly collected, it is important to consider the burden and costs of implementing new data collections or revising current data collection processes. When new data collections are too costly or burdensome, or if existing collections are performed so infrequently that the data are of minimal use, consider whether related data that are regularly and efficiently collected may be a more appropriate choice for an early warning system. Missing and nonstandard data, such as data from alternate assessments, may impact a system's effectiveness and need to be considered when designing analytical models, performing analyses, and creating data reports.

Demographic Data

The inclusion of demographic data and data on other student characteristics should be approached with caution. These types of data may include—but are not limited to—gender, racial/ethnic group, English learner status, special education program participation, and socioeconomic status. Early warning system planning teams should carefully consider whether these data contribute to the accuracy and predictability of a system. Planning teams must determine whether there is a strong correlation between these data and on-time graduation after adjusting for student risk level based on behavioral data, such as attendance and course performance. A student's individual demographic data may be useful to consider for identifying the best intervention for that student, but care should be exercised to ensure that demographic data do not become a primary factor in assigning at-risk status in lieu of more predictive indicators.

Out-of-School Data

Early warning indicators are typically based on student attributes and behaviors that can be influenced by school-based interventions. If available, data on out-of-school factors can provide useful descriptive information that could help staff better understand a student's individual circumstances and develop tailored interventions to accommodate these out-of-school factors. Out-of-school data are particularly useful when schools partner with community organizations and local social services agencies to provide individualized student interventions. These data include, but are not limited to, homelessness, involvement with the criminal justice system, involvement with social services or foster care, reports of substance abuse, pregnancy/teen parenthood, mobility, migrant status, and military connectedness.

Early Warning Data Analysis

Early warning system data are analyzed based on predetermined early warning indicators that identify the extent to which a student is at risk of dropping out of school.

Analytical Models

SEAs and LEAs use different techniques when analyzing their early warning data. Identifying and selecting which analytical model to use is an important step in the early warning system planning process. Rumberger and Lim's (2008) analysis of 25 years of peer-reviewed studies on early warning systems found that multivariate statistical techniques, such as logistic regression, were commonly used to analyze early warning data. Analytical model design choices, such as selecting the type of model to use, which indicators to include, and which outcome to predict, are agency-specific decisions.

Models may determine student risk through analysis of each indicator independently, or as part of a multivariate analysis. Determination of student risk based on multiple indicators can be more accurate than analyzing indicators independently. For example, if a single failing grade or chronic absenteeism event triggers an "at-risk" condition, many students who are not at high risk of dropping out may be flagged as at-risk. Multivariate analysis may be confusing for some users, but effective data visualization and reporting techniques can help make this approach more useful and user friendly.

Accurately Identify Student Risk

The goal of an early warning system analytical model is to maximize the number of students correctly identified as at-risk while minimizing the number of students incorrectly identified, either as at-risk or not at-risk. That is, the goal is to maximize the number of true positive results while minimizing the number of false positives and false negatives. Early warning indicators that are not locally validated may lead to over- or under-identification. For example, if a districtwide early warning system identifies 20 percent of students as at risk of dropping out, but the district only has a 5 percent dropout rate, a system may be over-identifying student risk levels and creating false positive results.

Agencies should be aware that discrepancies between an early warning system's assignment of at-risk status and a district's or state's dropout rate may not be a result of over- or under-identification, but indicative of successful student intervention. For example, a district with a 10 percent dropout rate whose early warning system identifies 15 percent of students as at-risk may not be over-identifying students, but rather providing successful intervention programs and services that are resulting in reduced dropout rates.

When establishing thresholds, it is critical to identify the level of risk at which dropping out becomes more likely than not for students. Lower thresholds identify more students as at risk of dropping out but may also assign some level of risk to students who demonstrate minimal or very low risk. Conversely, higher thresholds minimize the likelihood that students may be inaccurately identified as at-risk but may also miss some students who will eventually drop out. Agencies need to consider the tradeoffs between using broader or narrower thresholds, how many students can reasonably be served if flagged as at-risk, and how to prioritize students from greatest to least in need of intervention. Regardless of which thresholds are established, there needs to be a valid analytical approach to identify student risk and an effective process to refer at-risk students to interventions.

Interpret Data

Data interpretation can provide essential insight into why a student may be at risk of dropping out of school and should be included as an explicit part of the data analysis process. Interpreting early warning system data with data captured in a different system, such as a student information system (SIS), can point to the underlying causes of individual student risk, help staff better understand the specific needs of individual students, and enable the development of interventions that directly address students' individual challenges and barriers. Consider a chronically absent student who is flagged as at-risk by an early warning system. The student may be facing a wide range of attendance barriers that are not readily apparent based on data captured by an early warning system. Reviewing data that are recorded in an SIS may reveal that the student faces transportation challenges. With this information, school staff will be better equipped to develop an intervention that will address the student's specific need for reliable transportation, which will help improve the student's attendance.

Next Generation Early Warning Systems, Indicators, Data, and Analytics

Indicator identification, data definition, and analytical model design are not one-time activities. Indicators, elements, and analytical models should be iteratively refined as part of an education agency's regular process of system improvement. Agencies can adapt the continuous improvement process (described in chapter 1 and illustrated in figure 1) to support the planning, development, implementation, and evaluation of system changes. This will help the system remain responsive to the evolving needs of agency stakeholders. The decision to introduce new features, indicators, data, and analysis techniques into a system should be determined based on whether these changes will improve the accuracy, effectiveness, timeliness, and usability of a system's predictive abilities.

Next-Generation Systems

More robust early warning systems can identify students who experience major changes in performance but are not yet considered at risk of dropping out. For example, a student with a 4.0 GPA whose GPA drops to a 2.0 may not be at risk of dropping out but may need an intervention to help improve their academic performance. Early warning systems are traditionally student focused, but their data may also be used to assess organizational risk levels. Districtwide and statewide systems may identify schools with particularly high dropout rates, which may indicate the need for a school-level intervention. Similarly, if more students exhibit higher risk levels in a school that should have lower levels based on peer school performance, this may be interpreted as a school-level warning. The decision to use an early warning system in this manner should be made carefully to ensure that this approach does not negatively affect the primary purpose of a system: to identify students in need of intervention.

Next-Generation Indicators

Early warning and college readiness indicators measure related student success outcomes that can predict the likelihood of high school and college graduation (Allensworth, Nagaoka, and Johnson 2018). The alignment of an early warning system with college and career readiness (CCR) initiatives should be complementary, meaning that the system's ability to identify students in need of intervention should not be compromised to support improvements to CCR initiatives. Incorporating CCR indicators into an early warning system could be a useful way to support student success post-graduation (National Forum on Education Statistics 2015). These indicators might include the presence of an individualized or personalized learning plan, enrollment in a career/technical education pathway program, Advanced Placement coursetaking, or enrollment in a dual high school/college credit course. Early warning systems can also be linked to a CCR information system to alert counselors when a student's GPA falls below the threshold needed for entrance into the student's college of choice. The *Forum Guide to College and Career Ready Data* (2015) examines how SEAs and LEAs are using data to support CCR initiatives.

Next-Generation Data

Many SEAs and LEAs have access to more sophisticated data now than in previous years, including data related to student satisfaction with school, student engagement, and social-emotional learning. These types of data may be useful for identifying students at risk of dropping out. Including pre-high school data in early warning systems, such as attendance data and test results from elementary and middle school, may enable earlier identification of a student who needs intervention services. Additionally, some early warning systems may use historical trend data to determine student risk. In these cases, a student who is chronically absent in only the most recent school year may be assigned a lower risk of dropping out than a student who is chronically absent for 3 years in a row.

Early warning data can also support programs and services that use similar data. Bossier Parish Schools (LA), for example, recently modified the early warning module in its vendor-provided SIS to help screen students for admission to a competitive educational program with limited enrollment. Previously, staff manually pulled attendance, behavior, and coursework data from the SIS, and used these data to screen and rank students using a manual rubric. Staff configured the early warning system module to use the early warning data to positively score and identify the strongest applicants for the competitive program. This process not only reduced the amount of time required to process data for the competitive educational program's admissions process, it has also helped the district learn more about how the early warning module could be developed and implemented within the district.

Next-Generation Analytical Models

Next-generation analytical models are more sophisticated and may use weighted indicators to analyze data within specific subgroups of students; points systems, which assign points based on student performance and behaviors in relation to specific indicators; or tier systems, in which students are classified at low, medium, or high risk of dropping out of school. The classification and regression tree (CART) model is an emerging tool in early warning analytics. This method has shown promise identifying students at risk of poor performance on reading comprehension exams (Koon and Petscher 2015, 2016) and may be applicable to identifying students who are at risk of dropping out of school.

Questions for Consideration

It is important to determine which indicators, data, and analytics will be used in the early warning system prior to system development and implementation.

- What indicators will be used in the early warning system?
- Are the early warning indicators research-/evidence-based?
- Have the early warning indicators been locally validated?
- Which data will be used for each early warning indicator?
- Are these data readily available, or will your agency need to implement a new data collection?
- How frequently will the data be updated?
- How frequently and consistently will the early warning indicators, data, and analytical model be checked for accuracy? Will the system include automated data checks? Will the system include push notifications?
- What practices will your agency follow to ensure data quality?
- What steps will be taken to ensure system and data security?
- How will student privacy be protected?
- Which staff will be responsible for early warning data entry and analysis?
    - Administrators
    - Teachers
    - Research staff
    - Data management staff
    - Student intervention and support staff
- Which analytical model will be used to identify students at risk of dropping out?
- Will the early warning system only identify students who demonstrate a risk of dropping out of school? Or will the system also identify and warn of major changes in individual student performance?

Chapter 3: Effective Practices in Early Warning Systems Development, Implementation, and Use

The effective development, implementation, and use of an early warning system require an organizational commitment to acting on education data through data-informed decisionmaking.

Maximize Organizational Resources

Multiple organizational elements—people, processes, policies, and technology—need to work together if an early warning system is to be developed, implemented, and used effectively. Early warning system technologies should serve the needs of stakeholders and support the effectiveness of organizational processes and policies.

Education agency resources are finite. Thus, adequate time, money, and effort must be allocated for and invested in an early warning system if the system is to be successfully developed, implemented, and used. Constraints on agency resources should be considered and proactively addressed so they do not adversely impact a system's effectiveness. For example, if a local education agency (LEA) does not have research, policy, or data staff who can participate in the early warning system planning process, the agency may be able to partner with an external organization for technical assistance, such as its state education agency (SEA), its Regional Educational Laboratory (REL), or a postsecondary institution.

Technical Development and Implementation

Once early warning indicators and elements have been identified, they can be used to create detailed, documented technical specifications and system requirements. Establishing written requirements can help assess the appropriateness of different system development options. Early warning systems may be designed in-house by agency staff or purchased from a vendor or contracting agency. LEAs in states with an SEA-operated early warning system may be able to use the statewide system as is or modify the system to meet the needs of local stakeholders. Aligning an early warning system with information systems currently in use by the agency can enable automated data imports and quality checks. Establishing a systematic data import, analysis, and reporting schedule supports data quality and provides staff with actionable data for use in the development of student interventions and supports. Prior to formal implementation, a system and its data should be tested for accuracy and quality. If any data errors or usability concerns arise during testing, they should be addressed at this time.

Develop and Provide Staff Training

The introduction of an early warning system to an agency should be supported by thorough training. Staff training can advance three key goals:

- Help staff understand the purpose of an early warning system
- Teach staff how to collect, report, analyze, and interpret data using a system
- Prompt staff to use a system and its data in decisionmaking processes

Training materials can be customized to meet agency-specific needs or targeted to address the information needs of specific departmental or staff roles. Agencies with a vendor-created early warning system may be able to obtain training materials from the vendor or schedule vendor-led training sessions for agency staff. Training may be offered through in-person training sessions, written documentation, presentation materials, online tutorials, or videos. Some staff learn best through written and visual materials, while others may learn best through interactive training scenarios and exercises. Providing multiple types of training materials can help meet the needs of staff with different learning styles.

Training should be approached as an ongoing process to ensure that new agency staff are prepared to use the system. Scheduling staff training during the system development and implementation process can help identify potential barriers to system use. Early warning system training can also be incorporated into training materials and activities on related topics, such as data processes, decision support systems, or student intervention and support services. If major changes are made to a system while it is in use, be sure to review and update any related training materials.

Questions for Consideration

Early warning systems can help answer a variety of stakeholder questions. Anticipating and addressing stakeholder questions and information needs in training materials and resources can help encourage interest in and use of the system.

- ***Teachers:*** Which students are struggling in my courses and are not on track to graduate from high school?
- ***Counselors:*** Which students are at risk of dropping out or not graduating on time?
- ***K-12 School Administrators:*** How well is our school supporting all students to graduate from high school? What types of intervention programs should we offer to support our students?
- ***LEA Administrators:*** Which of our schools have the lowest rates of students on track for graduation? What types of intervention programs and resources are needed at schools in our district?
- ***SEA Administrators:*** Which LEAs have the lowest rates of students on track for graduation?

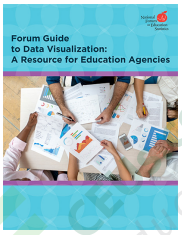
Adapted from the *Forum Guide to College and Career Ready Data* (2015)

Report and Share Timely Data

The frequency and purpose of data reporting and sharing activities may vary based on stakeholder information needs. Early warning data may be made accessible through dashboards, reports, or other outputs. For example, the Fairbanks North Star Borough School District (AK) regularly delivers presentations on the district's early warning system to key stakeholder groups. The district has also created posters, one-page handouts, and an online dashboard (https://public.tableau.com/profile/k12northstar#!/) to share information and aggregate data with stakeholders.

The need for data-informed actions and interventions should be emphasized when reporting and sharing data. Direct data access for all appropriate staff can help promote data use, and actively disseminating data to specific individuals can help make early warning data actionable. For example, the Appoquinimink School District (DE) supports early warning data use during regularly scheduled meetings with senior district administrators and through one-on-one meetings each marking period with each of the district's school principals. Supporting data drill-downs within a system also makes it easier for users to review individual student data and provide targeted interventions.

https://nces.ed.gov/forum/pub_2017016.asp



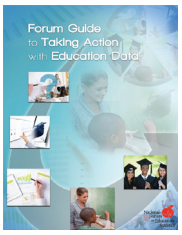
This guide recommends data visualization practices that will help education agencies communicate data meaning in visual formats that are accessible, accurate, and actionable for a wide range of education stakeholders. Although this resource is designed for staff in education agencies, many of the visualization principles apply to other fields as well.

Early warning data may also be included in regularly reviewed data reports, such as student evaluation and grade distribution data reports. Early warning system data can also be used to identify borderline students and/or students who experience major changes in behavior or performance but are not flagged as at risk of dropping out, such as a student whose grade point average (GPA) drops from a 4.0 to a 2.0 or a consistently attending student who becomes chronically absent. More robust data systems can generate additional reports that measure these types of major changes in student performance, which could then be used to identify students in need of early interventions.

Use Data to Inform Student Interventions

Early warning systems are more than just a tool to identify students who may eventually drop out of school. Early warning systems facilitate the use of education data in a manner that improves an education agency's ability to provide interventions, services, and supports to help students whose educational outcomes are at risk. It is important to ensure that a system and its data are used appropriately and connected to actions that improve student outcomes. Evaluating current mechanisms by which at-risk students are identified for interventions can identify opportunities for an early warning system to support current practices, programs, and processes.

https://nces.ed.gov/forum/pub_2013801.asp



The purpose of this guide is to help readers engage in the skillful and appropriate use of education data. It includes an introduction and three briefs written for educators, school and district leaders, and state program staff. Each brief is designed to provide stakeholders with practical information on the knowledge, skills, and abilities needed to identify, access, interpret, and use education data for action.

Stakeholder groups may need different types of data to inform action. As illustrated in figure 2, early warning system data may be used differently across an education agency based on the specific information and data needs of stakeholder groups. Staff should be encouraged to engage in data-informed discussions and act using early warning system data. Leveraging existing team-based structures and collaborative activities, such as team meetings, leadership meetings, and professional learning communities, can promote early warning system data use.

Figure 2. Representative examples of how early warning system data are used by stakeholders

The National Survey on High School Strategies Designed to Help At-Risk Students Graduate found that approximately half of the high schools that used an early warning system reported limited coordination between the system and the provision of other school services, including intervention programs (U.S. Department of Education 2016). Developing a culture of data use, encouraging data-informed decisionmaking, and clearly linking specific intervention programs and services to student risk factors can help improve coordination between early warning systems and other school services.

Resource Spotlight: Dropout Prevention and Intervention

Several agencies and organizations provide resources and assistance on dropout prevention and intervention. SEAs and LEAs may find it useful to consult these resources as they consider how to best provide intervention programs and services to students who are at risk of dropping out of school.

Diplomas Now
http://diplomasnow.org/
Diplomas Now, funded in part by a U.S. Department of Education Investing in Innovation Fund (i3) grant, is a program that helps middle schools and high schools develop a comprehensive plan to improve student achievement. Diplomas Now partners with schools to set goals, develop a strategic plan, implement an early warning system, and engage in regular data reviews. The program also provides curriculum, teacher coaching, and student support to help each student get back on track.

Everyone Graduates Center
http://new.every1graduates.org/
The Everyone Graduates Center, a unit of the Johns Hopkins University School of Education, seeks to identify the barriers that stand in the way of all students graduating from high school prepared for adult success, develop strategic solutions to overcome these barriers, and build local capacity to implement and sustain these strategic solutions. The center offers multiple resources on the effective development, implementation, and use of early warning systems, including compilations of resources used by state partners.

What Works Clearinghouse
https://ies.ed.gov/ncee/wwc
Resources on research-based interventions are available through the What Works Clearinghouse (WWC). WWC reviews existing research on different programs, products, practices, and policies in education to provide educators with the information they need to make evidence-based decisions. The WWC guide *Preventing Dropout in Secondary Schools* (Rumberger et al. 2017) provides recommendations that focus on reducing high school dropout rates.

Letters from the Field – Using an Early Warning System to Support Student Interventions

The Fairbanks North Star Borough School District (AK) recently hired four new social service managers, who started a few weeks into the Spring semester 2018. The managers' primary role is to coordinate, implement, and provide interventions and services to students whom the district's early warning system identifies as at high or medium risk of dropping out. The catalyst for creating these new staff positions came from a presentation to the Fairbanks North Star Borough School Board. This presentation focused on the work and evidence of success with a former grant program using the district's early warning system and showed that focused interventions could reduce the district's dropout rate and reduce dropout rate gaps between demographic groups.

The social service managers have already benefitted from using the district's early warning system to inform their work. The managers noted that the early warning system was especially useful in establishing their caseloads by meeting with counselors and principals to review children at high risk of dropout. The managers have worked with many children who would have fallen through the cracks if not for the early warning system. Their department found that students who were considered at risk of dropping out were not consistently prioritized for intervention services. The early warning system reminds school staff that the most vulnerable children are the population who will make the greatest gains with intervention.

The social service managers have implemented numerous successful interventions during their first semester, including the following:

- A student with runaway status and poor mental health received counseling, a recommendation to a community social service agency, and assistance to help meet basic food and clothing needs. The student stabilized at a community agency and was able to receive residential behavioral health services and to improve attendance. The family increased positive engagement with the school, and the student received personalized supports for social and emotional needs.
- Information from the early warning system helped identify a student who was at risk of dropping out. The student disclosed information—including that the student lived in a car and had limited access to food and basic needs—that qualified the student and the student's siblings as eligible for McKinney-Vento services.* Collaboration between social service managers helped the family receive assistance with transportation, basic needs, and recommendations to community supports.
- A high school student with multiple risk factors faced several barriers, including homelessness, financial stress, a lack of transportation, and minimal parental support. The student expressed a goal to graduate from high school but recognized the unlikelihood of overcoming current barriers without support. In addition, because of the student's age and independence, the student felt isolated in a traditional high school setting. Upon exploration, the student agreed to enroll at the Career Education Center, and the student's academic performance and truancy patterns improved. The Career Education Center is a self-paced program for students who have not been successful in the district's traditional high schools. Students in the program may earn a diploma by meeting the same requirements that all students in the district must meet, independently and at their own pace.

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* For more information, see the McKinney-Vento Education for Homeless Children and Youths Program.

Evaluate System Effectiveness

System evaluation provides critical information on system strengths and weaknesses, which can be used to implement changes that support continuous system improvements. Regular evaluation of an early warning system may focus on the following areas:

- **System accuracy –** The analytical model and early warning indicators need to meet agency standards regarding the accurate identification of students in need of intervention. Early warning system data that are ready for retirement may be used to evaluate how effectively the system identifies students in need of assistance. Integrating systems can also be a useful strategy; for example, if a student is assigned a dropout code in the student information system, an automated system check could determine whether that student was previously flagged in an early warning system.
- **System performance –** Routine system maintenance, such as quality assurance checks and security audits, can identify needed system improvements.
- **System utility and actionability –** A system's usefulness in helping staff and stakeholders identify students in need of intervention can be evaluated in multiple ways. User statistics, such as login data, can be used to determine how frequently and consistently a system is used by different stakeholder groups. Surveying users can solicit feedback on the accessibility and usefulness of an early warning system. Engaging an external agency in the evaluation process may solicit more candid responses from users on a system's benefits and challenges.
- **Intervention effectiveness –** Evaluating intervention outcomes will determine whether interventions are successfully helping students who were at risk of dropping out. Monitoring students who are no longer at risk of dropping out can also be useful in determining the effectiveness of specific interventions. SEAs are less likely to be involved in evaluating student-level interventions than LEAs, as they do not work directly with students.

Once needed changes and improvements to a system are identified, a plan should be developed to support the implementation of changes and improvements. Agencies can adapt the continuous improvement process (described in chapter 1 and illustrated in figure 1) to support the planning, development, implementation, and evaluation of system changes. If a system was built in-house by the agency, agency staff can more readily act to improve the system based on evaluation data. Agencies with an externally developed system can coordinate with the system's creators—vendors, organizational partners, or others—to implement system changes based on evaluation data.

Questions for Consideration

There are many factors that contribute to the success of an early warning system. Developing a plan for how your agency will support the early warning system development, implementation, and use process can help ensure that the system will be beneficial to users and inform student interventions.

- How will training be provided to agency staff? Will training be provided before, during, or after implementation?
- How will the early warning data be disseminated to users? Will data be available to users through a report, dashboard, or some other method?
- How will student privacy be protected when reporting, sharing, and using data?
- Who will be the primary users of the early warning system, and for what purposes will they use early warning data?
- How will the early warning data be communicated to stakeholders?
    - Internally to agency staff and administrators
    - Externally to other education agencies
    - Publicly to parents, community partners, and other local and regional stakeholders
- Does your agency have a communications plan?
- Which staff will be responsible for reporting early warning data?
- How will your agency encourage the systematic use of early warning data?
- Are there formalized structures and processes in place to support system implementation, sustainability, and use by a variety of stakeholders?
- Are there specific processes in place for when the early warning system identifies students in need of interventions? Which staff will be involved in these processes?
- Do specific intervention programs and services exist to help students identified through the early warning system?
- How will the effectiveness of the early warning system be evaluated?

Chapter 4: Case Studies From State and Local Education Ageies

This chapter provides an overview of how early warning systems are used in different state and local education agencies (SEAs and LEAs). The seven case studies included in this chapter offer a closer look at how SEAs and LEAs have implemented, or are in the process of implementing, an early warning system.

State and Local Early Warning Systems

The planning, development, implementation, and use of early warning systems is enhanced when SEAs and LEAs work together. LEAs can provide their SEA with useful insights into local needs, issues, and concerns, which the SEA can take into consideration when planning a statewide early warning system.

SEAs can provide LEAs with support in a variety of ways. SEA research staff may be able to assist LEAs with indicator identification and validation if the LEA does not have a researcher on staff. Statewide early warning systems developed by the SEA can provide LEAs with a set of indicators and data that can be used to create a local-level system that meets local stakeholder needs. In schools and districts that already have a local early warning system, it could be useful to review the statewide early warning system to see which aspects of the statewide system overlap and support the local system.

While both statewide and local early warning systems are designed to support improved student outcomes, SEAs and LEAs approach these systems in different ways. Statewide early warning systems can be used to inform state education policy, monitor statewide dropout risk rates, and help LEAs improve graduation rates. Statewide early warning systems include data on more students than local early warning systems, which can reveal important trends that wouldn't be visible at the LEA level. This can also provide LEAs with information on students who transfer between districts within the state, which can help ensure that transfer students in need of support receive intervention in a timely manner. SEAs may develop guidelines, processes, or requirements that govern how LEAs report data for use in a statewide early warning system, but requiring all LEAs in the state to use the statewide system is uncommon. Additionally, some SEAs can develop a statewide early warning system without being able to directly implement student-level interventions.

Additional information on statewide early warning systems is available from the Statewide Longitudinal Data System Grant Program's *Development and Use of Early Warning Systems* (Curtin, Hurwitch, and Olson 2012).

Case Studies

This chapter presents seven case studies that detail the actual experiences of SEAs and LEAs that have implemented, or are in the process of implementing, an early warning system. The case studies are presented in alphabetical order by state; for states with both an SEA and LEA case study, the SEA case study is presented first. A summary of the lessons learned from these case studies is included at the end of this chapter.

In broad terms, most of the case studies address the following aspects of the early warning system planning, development, implementation, and use process:

- Overarching descriptive information about the agency
- Description of the system planning, development, and implementation process
- Review of system indicators, data elements, analytical approach, and data quality practices
- Discussion of system and data use, including the development and implementation of student interventions
- Lessons learned

These case studies are presented as examples that schools, districts, and states can learn from as they begin planning for a new, or continue to use an existing, early warning system. SEAs and LEAs who are planning to implement, or are in the process of implementing, an early warning system may find it useful to learn about how another agency developed and used an early warning system.

Case Study: Fairbanks North Star Borough School District, AK

The Fairbanks North Star Borough School District created an early warning system, called the Dropout Risk Model, in the 2009-10 school year to improve the effectiveness of its Graduation Success Program. The Graduation Success Program provided targeted interventions to students in kindergarten through 12th grade and received funding through the American Recovery and Reinvestment Act of 2009 in the program's last 2 years of operation. While the Graduation Success Program concluded at the end of the 2010-11 school year, the district continues to use the Dropout Risk Model as a tool to help ensure that students who are at high risk of dropping out of school receive the interventions they need to succeed.

Agency Background

Fairbanks North Star Borough School District serves approximately 14,000 students enrolled in 35 public schools. The adjusted cohort graduation rate is 74 percent. Approximately 60 percent of the student population is categorized in the White racial/ethnic group, while the next largest student groups are the Two or More Races group (14 percent) and the American Indian/Alaska Native group (9 percent). Approximately 35 percent of students qualify for free or reduced lunch, 16 percent have an Individualized Education Program (IEP), and 3 percent are English learners. (Source: ED, NCES, CCD, School Year 2015-16; ED*Facts*, School Year 2015-16). *Note: These numbers represent the most recent ED data and do not necessarily reflect the latest district data.*

System Planning and Implementation

In the 2006-07 school year, the Fairbanks North Star Borough School District implemented the Dropout Prevention Program (later renamed the Graduation Success Program) to address the needs of students who were at risk of dropping out of school. In the 2008-09 school year, a district researcher participated in the program's annual evaluation process. The researcher's analysis of dropout rate data showed that a statistically comparable group of students not served by the program were twice as likely to drop out of school when compared with students who were served by the program. These findings also identified an opportunity to dramatically improve the program's effectiveness in reducing dropout rates using an early warning system. The analysis showed that the district dropout rate was predicted to have been 6.0 percent had the program not been in place; 5.4 percent with the program in place; and 4.2 percent if the program had used an early warning system to make service decisions.

Based on these findings, the researcher recommended continuing the Graduation Success Program and creating a new early warning system, the Dropout Risk Model, to inform the provision of program services to students. It was predicted that changing the population of students served by the program would more than double the program's effectiveness in reducing district dropout rates. Prior to the implementation of the Dropout Risk Model, students were identified as in need of program services based on vague criteria and unsystematic referrals. District leadership decided to implement the changes recommended by the program evaluation. School and district staff and administrators, including district superintendents, assistant superintendents, school principals, data management staff, research staff, and Graduation Success Program staff participated in planning for and implementing the changes recommended in the program evaluation. The Dropout Risk Model was developed in-house by the district researcher, who had knowledge and expertise in statistical modeling. The researcher was solely responsible for creating the Dropout Risk Model, including determining which indicators would be used.

Early Warning Indicators, Data, and Analytics

The Dropout Risk Model uses eight early warning indicators to calculate each student's dropout probability. These indicators focus on attendance, course and assessment performance, on-track progression, and out-of-school suspensions.

Indicator definition and determination was guided through local validation using internal agency data. Additional indicators were also suggested by staff and the published research on early warning indicators. A statistical analysis of 10 years of longitudinal data was performed to identify indicators for inclusion in the model. Several indicators were considered in this analysis, but only indicators that reduced the false positive rate and increased the true positive rate were included in the model. For example, students with high rates of tardiness showed higher dropout rates in general, but since tardiness data did not reduce the false positive rate and increase the true positive rate, these data are not included in the model.

Another important model design consideration was whether to include student demographic data. Ultimately, any indicators related to student demographics or factors outside of the control of the student or the school were excluded from the model, including data on gender, race/ethnicity, economic disadvantage, homelessness, migrant status, English learner, military connectedness, and disability status. Thus, the model determines student risk based on what students do, not who they are.

No new data collections were necessary to support the Dropout Risk Model, as all the data elements were already available. Most of the data are included in the district's annual report to the SEA. Any data not included in this report are extracted from the student information system (SIS) or sourced from preexisting data files, such as state assessment reports. Additionally, certain data are compiled and transformed for inclusion in the model. For example, kindergarten through third-grade students do not receive letter grades using the A, B, C, D, F grading system, but grading data for these students are aligned with a 4.0 grading scale for inclusion in the Dropout Risk Model.

Early Warning Indicators

- Attendance rate
- Difference between high school credits and number of years in high school
- District assessment performance
- Former dropout
- Grade point average (GPA)
- Retention
- State test performance
- Out-of-school suspensions

Early Warning Indicator Data Elements

- Aggregate daily attendance
- Aggregate daily membership
- Accrued high school credits
- Number of years in high school
- National percentile rank for AIMSWeb reading assessment
- National percentile rank for AIMSWeb math assessment
- Former dropout
- Grades issued in each course
- Retained designation
- Proficiency on state standards-based math assessment
- Proficiency on state standards-based reading assessment
- Proficiency on state standards-based science assessment
- Proficiency on state standards-based writing assessment
- Out-of-school suspensions

District technology staff support the district's data processes and are involved in collecting, disseminating, and displaying the data. Additional departments and staff participate in the data collection process as appropriate; for example, student grades are submitted through the district's SIS and daily attendance is tracked by attendance secretaries in each school. Each data file used in the Dropout Risk Model is heavily vetted for accuracy and several departments participate in reviewing the district's annual report prior to submission to the state.

The analytical model was developed over a few months and implemented during the 2009-10 school year. The model assigns students a risk level of low, medium, or high using a custom analytical approach. First, an initial risk level is calculated through a logistic regression model of two indicators: attendance and grade point average (GPA). Then, the remaining early warning indicators, each of which have established independent cut-points, are incorporated into risk level determination using a process similar to classification trees. This custom analytical model retains the complexity necessary for sufficient reliability and validity but is easier for users and stakeholders to understand than a multivariate logistic regression model. The model is designed to increase the true positive rate and decrease the false positive rate through reliable and valid analysis, and identify a smaller number of students through increased, but understandable and transparent, model complexity. The district researcher who created the model performs all data analyses and reporting. Since initial implementation, minor changes have been made to the model based on staff feedback and impact analysis results.

Risk level data for each student in grades K-12 are stored in a data file, which technology staff upload into the SIS. The SIS's primary screen displays each student's risk level using a custom color-coded dot icon (a green dot represents low risk, yellow represents medium risk, and red represents high risk). A data file, which includes risk-level data, is also sent to each principal each year.

System Use

After the Dropout Risk Model was implemented in the 2009-10 school year, the district needed to determine how the Graduation Success Program would use the model to determine which students would receive services. At the time, 19 program staff were responsible for serving 1,000 students. The ratio of staff caseload capacity to students who would potentially benefit from program services was quite high, which limited the program's ability to serve all students identified as medium and high risk. The district's data showed high-risk students comprised only 12 percent of student enrollment but comprised roughly two-thirds of all district dropouts. Furthermore, a propensity score matching of student data showed a comparable 50 percent reduction in dropout rates across all 3 risk categories, meaning that students at high risk of dropping out were equally likely to benefit from program services as those students who were at medium and low risk. To maximize the program's effectiveness in reducing the district dropout rate, district administration set the expectation that the program was to exclusively serve students who were identified by the model as high risk. An implementation review was also conducted to verify the program's conformity with this change. This expectation helped ensure that the program's limited resources were allocated to the group of students who would have the strongest influence on district dropout rates.

School principals, social service managers, counselors, and prevention/intervention specialists use the model's risk-level data to prioritize and assign students to interventions, services, and programs. To further encourage support for and use of the model, the model creator has delivered presentations to key leaders and stakeholders, including principals, federal program staff, Graduation Success Program staff, community achievement focus groups, and the School Board. These presentations have been particularly effective at generating support for the model. As an example, a presentation to the School Board showed that focused interventions could reduce the district's dropout rate and reduce dropout rate gaps between demographic groups. Furthermore, each student that remained in school ensured continued base student allocation funding for that student, making the model a positive return on investment for the district. This presentation served as a catalyst for the Board to consider specific methods to implement targeted interventions and motivated the

district to hire four new social service managers. The primary role of these new staff is to coordinate, implement, and provide interventions and services to students who are identified as high and/or medium risk.

Since the model was first implemented, its effectiveness has been evaluated based on the district dropout rate. The served student group dropout rate is compared with the dropout rate of a comparison group defined through propensity score matching. Sufficient evidence has shown that the Graduation Success Program's services to high-risk students directly reduced the districtwide dropout rate, and the district dropout rate has remained consistently lower for students who received services than a comparable group of students who did not receive services. In the first year that data generated by the Dropout Risk Model were used to assign students to services and interventions provided by the Graduation Success Program, the district dropout rate was 4.2 percent, the lowest recorded dropout rate for the district. In the following school year (2010-11) the dropout rate was even lower, at 3.9 percent.

Lessons Learned

- **Balance complexity and transparency.** The creator of the Dropout Risk Model noted that model design choices are especially important when creating an early warning system. They found that the use of certain statistical methods can make the analytical model more complex without drastically compromising transparency, which can help overcome some of the barriers associated with using a complex analytical model.
- **Devote adequate time to model development.** The district's development and implementation of the early warning system was relatively quick, allowing only a short period of time to develop the analytical model. As a result, multiple model refinements were necessary after the Dropout Risk Model was implemented. The model creator recommended that early warning system planning teams budget a sufficient amount of time to the development of the early warning system analytical model.

Case Study: Delaware Department of Education

The Delaware Department of Education (DDOE) recently created an Early Warning System (EWS) plug-in as part of the state's Education Insight (EdInsight) Program. EdInsight, which was initially funded under Race to the Top in 2010, is a collection of projects and systems that support data-driven decisionmaking throughout the Delaware education system. The EdInsight Program has been in place for several years and includes Delaware's statewide longitudinal data warehouse and statewide performance management dashboard. The EWS plug-in is one of several projects that seek to leverage the EdInsight Dashboard to improve outcomes for all Delaware students.

Agency Background

The state of Delaware serves approximately 135,000 students enrolled in 227 public schools within 53 school districts. The adjusted cohort graduation rate is 86 percent. Forty-six percent of the student population is categorized in the White racial/ethnic group, while the next largest student groups are the Black or African American group (31 percent) and the Hispanic/Latino group (16 percent). Approximately 37 percent of students qualify for free or reduced lunch, 15 percent have an IEP, and 7 percent are English learners. (Source: Source: ED, NCES, CCD, School Year 2015-16; ED, OESE, School Year 2014-15). *Note: These numbers represent the most recent ED data and do not necessarily reflect the latest district data.*

System Planning and Implementation

The EWS planning and development process began in September 2017. The process was a collaborative effort involving SEA and LEA staff and external organizations. DDOE information technology (IT) and program staff worked with the Ed-Fi Alliance throughout the planning and implementation process. The Ed-Fi Alliance, funded by the Michael and Susan Dell Foundation, is a community of educators, technologists, and leaders committed to ensuring that schools, districts, and states can see, secure, and use education data. The EWS plug-in was originally developed by the Pennsylvania Department of Education (PDE) and was made available to Delaware through the Ed-Fi Exchange. Delaware worked with an Ed-Fi consulting group to adopt and modify the plug-in to meet Delaware's needs. Use of the plug-in incurred no major cost to the DDOE, although there was a small cost to incorporate the plug-in into the EdInsight Dashboard.

DDOE worked with an oversight committee to help guide goal setting, project planning, communications, and product review processes. Individual SEA and LEA staff participated in the EWS development process through a formal stakeholder engagement program. DDOE conducted two focus groups with invited LEA representatives. These focus groups included discussion on the topic of dropout prevention, demonstration of the EWS plug-in developed by PDE, and discussion on the relevance of the system to Delaware. A dedicated EdInsight data coach also collected formative feedback on the plug-in via interviews to help identify potential enhancements to the plug-in.

System integration and testing occurred in Winter 2018 prior to statewide release. DDOE worked with an external vendor to incorporate the EWS plug-in into the EdInsight Dashboard. A DDOE IT developer is responsible for vendor coordination, and a DDOE analyst is responsible for ensuring data quality and accuracy. DDOE's established and stable software application deployment process and relationship with the Ed-Fi Alliance has resulted in faster development time and reduced cost to the agency.

Early Warning Indicators, Data, and Analytics

The indicators used in the EWS plug-in were selected based on research conducted for PDE by a leading early warning researcher. This research identified the "ABC" indicators (attendance, behavior, and course performance) as critical in the

early identification of students who are at risk of dropping out of school. DDOE reviewed these indicators with district and school staff during the EWS planning process to ensure that LEAs understood how the indicators are applicable in Delaware.

Early Warning Indicators

- Attendance
- Behavior
- Course Grades in Language Arts
- Course Grades in Mathematics

The EWS requires no new data collections or data entry activities to support implementation and use. Instead, the EWS plug-in uses data that are stored in the statewide SIS. Each day, the prior day's data are extracted from the SIS, loaded into the state data warehouse, and then transformed and loaded into the EdInsight Dashboard. Several data standardization checks are performed throughout the extract, transform, and load process. DDOE also performed a series of thorough data checks in alignment with the agency's agile system development processes.

The EWS plug-in automatically flags students as at risk of dropping out of school if student data related to at least one at-risk indicator are found to be above a predefined threshold. No additional data analytics are required for the plug-in to identify whether a student is at-risk. The EdInsight Dashboard uses course grade metrics to measure major changes in student performance, but these metrics are distinct from the course grade indicators used in the EWS.

In February 2018, the EWS plug-in was deployed statewide and made available to approximately 13,000 active EdInsight Dashboard users. The EWS will help LEAs quickly identify whether a student has been flagged as at-risk, including students who recently moved between districts and schools within the state, which will enable LEAs to provide interventions to students.

System Use

The DDOE has several mechanisms in place to support LEA use of the EWS plug-in. Documentation on how to use the EdInsight Dashboard and EWS plug-in is easily accessible online, and the DDOE has created a plan to guide the agency's EWS-related communication activities. DDOE has a dedicated EdInsight data coach who provides free on-site staff training to every LEA during professional learning community time and staff meetings; these training sessions will include information on how to use the EWS plug-in.

Presentations on the EWS plug-in will also be delivered at the DDOE's regularly scheduled monthly cadre meeting. LEA staff, including data managers, curriculum directors, school counselors, IT directors, and lead teachers, attend the monthly cadre meetings. The DDOE regularly encourages EdInsight Dashboard use during cadre meetings and often incorporates a presentation on the Dashboard into the meeting. These meetings provide LEAs with the opportunity to share how they use data to drive local decisionmaking processes.

The DDOE anticipates LEA feedback on the EWS during future monthly cadre meetings and EdInsight training sessions. DDOE expects that this feedback will be used to inform continued developments and improvements to the EdInsight Dashboard and EWS plug-in. The DDOE hopes that LEAs will be motivated by the EWS plug-in to develop a portfolio of resources and interventions to assist students and reduce their risk of dropping out of school. In support of this goal, DDOE is considering working with the University of Delaware to provide resource recommendations and opportunities to LEAs.

Lessons Learned

- **Collaborate with trusted partners.** The time necessary for system development was greatly reduced due to the DDOE's collaborative partnership with the Ed-Fi Alliance. The help provided by the Ed-Fi Alliance enabled the DDOE to implement the EWS plug-in in a short timeframe and at a significantly reduced cost.
- **Solicit feedback to ease system implementation.** DDOE has taken steps to support the ease and effectiveness of the system implementation process. The Department pilot tested the system with select LEAs throughout the state, and feedback from participants was used to make system changes and improvements prior to statewide release.
- **Communicate early and often.** DDOE found it useful to share information about the system with LEAs during the state's monthly cadre meetings. This provided LEAs with the opportunity to learn about the benefits of the system, which built anticipation leading up to the EWS's statewide release.

Case Study: Appoquinimink School District, DE

The Appoquinimink School District is very focused on education and has strong support from community stakeholders, which has helped the district maintain a consistently high graduation rate. Although the district dropout rate is consistently low, district staff and administrators were interested in better understanding what factors may influence a student's decision to drop out of high school.

Agency Background

Appoquinimink School District serves approximately 10,000 students enrolled in 16 public schools. The adjusted cohort graduation rate is 90 percent. Approximately 60 percent of the student population is categorized in the White racial/ethnic group, while the next largest student groups are the Black or African American group (25 percent) and the Hispanic/Latino group (7 percent). Approximately 15 percent of students qualify for free or reduced lunch, 14 percent have an IEP, and 2 percent are English learners. (Source: ED, NCES, CCD, School Year 2015-16; ED*Facts*, School Year 2015-16). *Note: These numbers represent the most recent ED data and do not necessarily reflect the latest district data.*

System Planning and Implementation

The Delaware Department of Education (DDOE) recently developed a statewide early warning system for LEAs to use. The district used this work by the DDOE as an opportunity to explore which early warning indicators are predictive of student dropout within the district. The statewide DDOE-created early warning system uses attendance, behavior, and course grades in language arts and mathematics to predict student risk of dropout. The district has used these DDOE-developed indicators as a baseline for developing a Student Index Warning, which serves as the district's first step in locally validating potential early warning indicators. The district is planning to locally validate these indicators, but has not yet done so. The Student Index Warning will be used to compare data from students who drop out of high school and students who graduate from high school. This comparative analysis will help determine what differences exist between these two groups of students and which early warning indicators are predictive of student dropout within the district.

Early Warning Indicators, Data, and Analytics

The Student Index Warning uses attendance, discipline, academic performance, and retention indicators to calculate a dropout probability score for each student.

In addition to data used in DDOE's early warning system, such as chronic absences and course failures, the Student Index Warning also draws on data available within the district. Both Smarter Balanced and MAP® Growth™ assessment data, as well as retention data, are included in the Student Index Warning. Data on student demographics, military-connected status, choice status, and transient status are also included. The Student Index Warning also tracks each student's grade of entry into the Appoquinimink School District, with a focus on whether students attended pre-kindergarten or kindergarten in the district. These data will be used to examine whether students who begin their educational career in the district are more likely to graduate than students who move into the district at a later grade level, with the goal of understanding what factors within district schools contribute to student success.

The Student Index Warning uses student data to calculate a points-based dropout probability score for each student. Each data element has an associated point system, and points from each data element are weighted equally in calculating dropout probability scores. For example, student grades are calculated using a 4-point grade point average scale: A grades are 4 points, B grades are 3 points, C grades are 2 points, and F grades are 1 point. Attendance is weighted using

an equivalent 4-point scale: Students with an attendance rate of 95-100 percent receive 4 points. By monitoring a wide variety of data over time, with each data element using a 4-point scale, the district will be able to determine which factors are valid predictive indicators of dropout for students enrolled in the district.

The Student Index Warning exists as part of the district's data files. Each school within the Appoquinimink School District has its own spreadsheet file of school-level data. The file includes 17 worksheets, one of which is the Student Index Warning worksheet. Each worksheet includes key data and statistics on a specific topic of interest, such as grade distributions, teacher evaluations, and final grade correlation data. Pivot tables in each worksheet enable connections between the file and other data sources. For example, when a user clicks on a data cell that shows a percentage figure of chronically absent students, the user can view a list of all chronically absent students and review each student's individual records.

Early Warning Indicators

- Attendance
- Discipline
- Academic performance
- Retention

Early Warning Indicator Data Elements

- Chronic absences
- Number of discipline referrals
- Number of suspensions (in-school and out-of-school)
- Course grades and failures
- Rasch Unit (RIT) scores from MAP® Growth™ tests
- Smarter Balanced assessment scores
- Retention

Other Data Elements

- Demographics
- Choice status
- Military connectedness
- Transient status
- Grade of entry

All Delaware districts and schools (public, charter, and alternative) use the same SIS, which helps facilitate data sharing between individual schools, their district central office, and DDOE. The Appoquinimink School District's central office Assessment, Accountability, and Educational Data Department staff manage the district's data systems and assist with exporting data from the SIS and importing the data into the district's data files. The data files, including the Student Index Warning, are updated each marking period; middle schools and high schools operate on a quarter marking period system, while elementary schools use a trimester marking period system. The district has iteratively developed and refined the file format and data update process over the past few years.

System Use

The Assessment, Accountability, and Educational Data Department supports school use of the Student Index Warning through regularly scheduled "data dig" meetings. The assessment, accountability, and educational data coordinator also reviews these data in meetings with senior district administrators, including the superintendent, assistant superintendents, director of instruction, and special education supervisor.

The assessment, accountability, and educational data coordinator travels to each school in the district to review the school's data together with the principal. Data dig meetings are held each marking period and are approximately two hours long. By providing a wide variety of data in one easy-to-view file, principals can view their school's data in aggregate, identify their school's strengths and challenges, and act to address issues in need of further attention.

After data dig meetings, school principals meet with school psychologists and response to intervention (RTI) teams to advise them of students who were identified by the Student Index Warning as in need of intervention. Interventions are provided by school RTI teams and student services staff.

Lessons Learned

- **Draw on community connections.** The assessment, accountability, and educational data department coordinator noted that connections within the education data community have been very helpful in developing and refining the Student Index Warning. Connecting with colleagues in the education data community has helped the Assessment, Accountability, and Educational Data Department learn about the barriers, strategies, and successes other states and districts have faced in developing, implementing, and using an early warning system.
- **Diversify data teams.** The Assessment, Accountability, and Educational Data Department staff come from diverse professional backgrounds. Some staff have professional experience in data analysis, accountability, assessment, and research, while other data staff have professional experience as educators and school administrators. This diversity of staff background has helped the Department better understand how they can help support school administrators and staff fulfill their roles and responsibilities, which has enhanced the Department's ability to provide data that are easy to use in analysis, evaluation, and decisionmaking.

Case Study: Montana Office of Public Instruction

The Montana state education agency, the Office of Public Instruction (OPI), was interested in lowering the state dropout rates for all students, especially among certain subgroups. To help schools lower their dropout rates and encourage data use among Montana schools, the OPI created a voluntary statewide early warning system, Montana EWS, in the 2011-12 school year. The Montana EWS was created in-house by an OPI research data analyst.

Agency Background

The state of Montana serves approximately 145,000 students enrolled in 830 public schools in 497 districts. The adjusted cohort graduation rate is 86 percent. Approximately 79 percent of the student population is categorized in the White racial/ethnic group, while the next largest student groups are the American Indian/Alaska Native group (11 percent) and the Hispanic/Latino group (4 percent). Approximately 45 percent of students qualify for free or reduced lunch and 12 percent have an IEP. (Source: Source: ED, NCES, CCD, School Year 2015-16; ED, OESE, School Year 2014-15). *Note: These numbers represent the most recent ED data and do not necessarily reflect the latest district data.*

System Planning and Implementation

Montana schools are not required to use the Montana EWS; instead, each school decides whether to implement it. An organizational culture that recognizes the importance of the Montana EWS and prioritizes its use is an important factor in whether a school decides to implement the Montana EWS.

It is sometimes challenging to convince schools that the Montana EWS is an important tool since school use of the Montana EWS is voluntary, is not required by any OPI programs, and is not attached to any funding sources. The OPI has used several strategies to encourage schools to implement and use the Montana EWS. The OPI has worked closely with several schools to help connect the Montana EWS to interventions that are currently in place in the school. Additionally, the OPI offers small grants to encourage EWS use and help schools implement student interventions. The Montana EWS was also a part of Graduation Matters Montana, a program that provided private grant money to communities for projects that encourage students to graduate from high school. Looking ahead, the Montana EWS is included in the state's Every Student Succeeds Act plan, and all schools that are identified as comprehensive or targeted support schools will be required to use the Montana EWS.

The system implementation process varies from school to school. The OPI is typically involved when schools make the initial decision to use the Montana EWS, and which OPI staff are involved is determined based on the needs of the specific school. Training is provided on-site at the school, and it addresses setting up an early warning system team, how to pull the data needed for the Montana EWS, how to read system reports, and other information. Training also includes a review of the school's analyzed early warning data, which identify student risk levels.

Montana does not have a statewide SIS that must be used by all schools across the state. This poses certain challenges in supporting statewide planning and implementation of the Montana EWS. The Montana EWS requires schools to upload data into the state data warehouse, and because schools use different SISs, system capability and data uploads can be challenging. To alleviate some of these issues, the OPI established a required format that must be used by all schools when uploading data into the Montana EWS. The OPI has also worked with schools and vendors to develop a data extract feature for the two most commonly used SISs in the state.

Early Warning Indicators, Data, and Analytics

The OPI used both external research and internal data to identify early warning indicators. OPI staff consulted external research to determine which indicators might be helpful to include in the Montana EWS. The OPI then analyzed its internal data to determine whether these research-based indicators were valid dropout predictors for Montana students. The Montana EWS includes four locally validated indicators: attendance, behavior, grades, and mobility.

No new data collections were required at the state or local level to implement the system, as most of the data required to use the Montana EWS are already collected by schools. The OPI provides roughly half of the data required to use the Montana EWS from datasets already collected and reported by schools and districts. These data are stored in the state data warehouse. Individual schools must provide the remaining data. Most of these data are already collected by schools but are not reported to the state. The Montana EWS has a feature in place to account for data elements that are not collected by the school, which reduces the potential burden associated with implementing a new data collection to specifically support EWS implementation.

The Montana EWS is stored in the state data warehouse. An overview of the Montana EWS is available to the public, but the Montana EWS results are only available through a secure, password-protected version of the site. Each user must submit authorization forms, which requires signatures from the proper school representatives, to receive a login and password for the secure version of the site. Individual schools decide which school staff are granted access to the system and OPI controls overall system access.

Several OPI staff work year-round to ensure that data are entered correctly and in a timely manner. Data that are collected by the state are updated on a nightly basis. Because the Montana EWS requires schools to upload their own data, schools control the frequency, consistency, and quality of their data. Data uploads from the schools are typically performed by data staff, while data analysis and reporting are usually completed by a curriculum director, counselor, principal, or other staff at the school. The quality of the data uploaded by the schools is the responsibility of the school, and the OPI has taken certain steps to help ensure schools report quality data. In addition to providing training to schools, the state data warehouse has several data quality checks to make sure data are formatted correctly. Data that are uploaded to the system must pass these data quality checks to be accepted; users receive an error message when data are not accepted. Most schools choose to update their data monthly, but the system's use of current data enables schools to update system data on a daily basis if they so choose.

Early Warning Indicators

- Attendance
- Behavior
- Grades
- Mobility

Early Warning Indicator Data Elements

- Attendance rate
- Absences in the last 60 days
- Absences in the last 90 days
- Number of behavior events in the last 120 days
- Number of out of school suspension events in the last 3 years
- Credits earned per year
- Number of previous term A's
- Number of previous term F's
- On track status to graduation
- Age difference from peers*
- Previously dropped out status
- Repeating a grade in K-8 (Retention)*
- Mobility this school year*
- Mobility from out of state*
- Number of towns/districts the student has attended school in*

Other Data Elements

- Age
- Gender*

*Data are collected by OPI

The Montana EWS uses a logistic regression analytical model to produce a percentage chance of dropping out based on each student's current data. Students are assigned a level of risk based on their results: low risk, at risk, and extreme risk. These results are made available to schools immediately after the data upload process is complete. The system provides these results based on the student's current data and stores the dated results from the previous 12 times that data have been uploaded for that student. The Montana EWS also generates school-level reports that aggregate the results of all the students in the school or district. In these reports, schools can see what percentage of students are flagged for each of the system's four risk indicators: attendance, grades, behavior, and mobility. These data are available for all students in the school and at each grade level. The state average and the previous results for that school are also provided. Using this information, schools can see in which areas their students struggle when compared to students in other schools in the state.

System Use

Each school uses the system, its data, and results a bit differently based on their individual needs. At most schools, principals and counselors are the main users of the system's early warning data. Other users may include curriculum directors, data analysts, teachers, and other school staff. At certain schools, students are provided with their individual results to help them better understand why they may be at risk of dropping out of school.

Schools can use the Montana EWS's reported results to identify which students at the school may need additional help, and then design targeted interventions that address why individual students, and the school overall, are struggling. Each school is responsible for developing and assigning students to intervention programs. The system's three risk categories (low risk, at risk, and extreme risk) correspond with many of the tiered intervention programs used by schools in the state, which can help schools determine which students should receive which types of intervention (universal, targeted, or intensive intervention). To evaluate the effectiveness of interventions, schools can use the system's longitudinal data to track students who are receiving interventions and determine whether those students benefited from the interventions they received.

The OPI has made several changes to the Montana EWS since the agency first implemented the system during the 2011-12 school year. Many of these changes were made based on feedback and suggestions provided by users from the field and include modifying the early warning indicators and moving the Montana EWS into the state data warehouse. The OPI also added new system features that allow schools to view different groups of students within the school and to see previous results for students that enroll in their school from another school within the state. The effectiveness of the system's analytical model is re-evaluated annually during the summer. The OPI reviews the Montana EWS's analytical model as well as feedback from users in the field, and then implements changes based on this evaluation to improve the model's effectiveness. In addition to using the Montana EWS for evaluation purposes, OPI staff also use the Montana EWS to determine whether the schools they are working with upload data into the system, and if so, how often the system is used.

Lessons Learned

- **Training is important.** The OPI noted that providing appropriate training is helpful to schools that use an early warning system. The OPI provides training at opportune times, including prior to system implementation, and as schools start to use the Montana EWS. Training activities also incorporate early

warning data from the school to help school officials better understand the effectiveness of the system, how risk level is assigned, and how the school can use the system. Schools that fully understood the results of the Montana EWS's results and how to use those results benefitted the most from the system.

- **Have a champion.** OPI found that schools with at least one champion who understands and fully believes in the early warning system benefit the most from the Montana EWS. Having a champion in place can improve the likelihood that the school will continue to use the early warning system.
- **Encourage data use.** The OPI observed that schools who regularly use the early warning system are more likely to fully benefit from the system and noted that creating an early warning system team that meets on at least a quarterly, and preferably monthly, basis to review the early warning data is helpful. Teams can review and discuss both school-level and student-level results, as well as how well current interventions are working for students who were identified as at risk of dropping out.

Case Study: Bozeman School District #7, MT

The Montana EWS is a voluntary statewide early warning system developed by the Montana Office of Public Instruction (OPI) in the 2011-12 school year. The Montana EWS analyzes the risk level of students in grades 6-12 at participating schools to determine student risk of dropout. The Montana EWS is used by the OPI to measure state dropout trends, and participation in the Montana EWS is at the discretion of individual schools and districts. The system is used in schools throughout Bozeman School District #7—including the district's high school, Bozeman High School, and one of the district's middle schools, Chief Joseph Middle School—with the support of the district's central office.

Agency Background

Bozeman School District #7 serves approximately 6,500 students enrolled in 11 public schools. The adjusted cohort graduation rate is 84 percent. Approximately 89 percent of the student population is categorized in the White racial/ethnic group, while the next largest student groups are the Hispanic/Latino group (4 percent) and the Two or More Races group (2 percent). Approximately 10 percent of students have an IEP and 1 percent are English learners. (Source: ED, NCES, CCD, School Year 2015-16; ED*Facts*, School Year 2015-16). *Note: These numbers represent the most recent ED data and do not necessarily reflect the latest district data.*

System Planning and Implementation

Multiple factors motivated Bozeman School District #7 to consider implementing the Montana EWS. Staff and administrators were interested in more comprehensively and holistically examining student needs. The district was also familiar with the Montana EWS through its participation in Graduation Matters Montana and relationship with REL Northwest, the Regional Educational Laboratory that promotes the use of Montana's early warning system.

The district formed a committee to consider the feasibility and appropriateness of implementing the Montana EWS. The District EWS Committee was comprised of building and district leaders (including the deputy superintendent, director of special education, high school principal, middle school principals, and elementary school principals), IT staff, central office staff, and Graduation Matters Montana representatives. Middle and high school principals also appointed appropriate staff from their schools to the committee, including assistant principals and at least one counselor from each building. Over the course of several years, the District EWS Committee coordinated its data systems, set a schedule for reporting frequency, established targets and goals for dropout prevention strategies across the district, and vetted student intervention options.

Bozeman School District #7 joined Project Responsive Education for All Learners (REAL) during the early warning system planning process. Project REAL is a grant-funded multi-tier system of supports (MTSS). Bozeman School District #7 uses the Montana EWS as an extension of the district's MTSS program and has used the Montana EWS consistently since the 2016-17 school year. To support planning and implementation at the school level, individual schools established teams to oversee the planning process and support the successful implementation and use of the Montana EWS. Communication with staff regarding the Montana EWS was important for creating an understanding of the system. The district also received extensive training and guidance prior to implementing the Montana EWS. The Bozeman School District #7 central office provided training before and during implementation. Additionally, the district participated in REL focus groups; organized meetings, workshops, and site visits; and consulted resources and technical assistance on early warning systems from the Montana Education Research Alliance, REL Northwest, and Graduation Matters Montana.

Early Warning Indicators, Data, and Analytics

The Montana EWS uses four early warning indicators—attendance, behavior, grades, and mobility—to calculate each student's dropout probability. The system also monitors good standing and changes in student performance and dropout probability. The district uses the same indicators as the OPI-created Montana EWS.

Data on mobility, retention, and gender are collected by OPI and imported into the Montana EWS, while attendance, behavior, and course performance data are collected and uploaded by districts. These data were already available, and no new school, district, or state data collections were necessary to support the Montana EWS.

The district uses several vendor-provided information systems. The District EWS Committee developed procedures for importing district data from these systems into the Montana EWS. At Chief Joseph Middle School, behavior and academic support staff, as well as MTSS leadership teams, are responsible for inputting, analyzing, and reporting early warning data to the district. At Bozeman High School, the high school's data teams work with the early warning data. Each data team includes the school's deans, a counselor, an administrator, and, as appropriate, support personnel such as a parent liaison, school psychologist, student support specialist, or nurse. The district data specialist is responsible for importing the early warning data into the Montana EWS for each participating school in the district. The district data specialist uses Structured Query Language (SQL) code to extract and upload the data necessary for the Montana EWS. The SQL code was developed by another Montana district that uses the same vendor-provided SIS. The query necessary for data extraction is complex and required considerable time to modify and refine. District data are pulled from the SIS and uploaded to the Montana EWS three times a year in fall (October), winter (January), and spring (May). The district data specialist also analyzes the data and prepares spreadsheets and reports to share with schools within the district. Principals, counselors, and MTSS teams are responsible for analyzing student-specific information at the school level.

Numerous steps are taken to ensure data security and protect student privacy. All data collection and reporting systems are secure, and early warning data are uploaded to OPI over Secure File Transfer Protocol. The system does not yet include automated data checks, but each data extraction includes data verification steps. Reports and student lists are shared confidentially on a need-to-know basis with administrators and counselors who hold an appropriate security clearance. Furthermore, all meetings that include reviews of the early warning data are confidential. Regular reviews of the early warning data have identified opportunities to improve data quality. Bozeman High School staff, for example, noticed that a few students identified as at risk of dropping out seemed like they should not be on the list. Administration consulted with central office staff and worked to correct historical grade issues that had impacted the accuracy of the Montana EWS's results.

Early Warning Indicators

- Attendance
- Behavior
- Grades
- Mobility

Early Warning Indicator Data Elements

- Attendance rate
- Absences in the last 60 days
- Absences in the last 90 days
- Number of behavior events in the last 120 days
- Number of out of school suspension events in the last 3 years
- Credits earned per year
- Number of previous term A's
- Number of previous term F's
- On track status to graduation
- Age difference from peers*
- Previously dropped out status
- Repeating a grade in K-8 (Retention)*
- Mobility this school year*
- Mobility from out of state*
- Number of towns/districts the student has attended school in*

Other Data Elements

- Age
- Gender*

*Data are collected by OPI

The Montana EWS uses multivariate logistic regression to calculate dropout probability and identify students at risk of dropping out. Students considered at risk of dropping out typically have one or two indicators that strongly influence their risk level. Support staff analyze each student's specific results according to the student's primary risk factor(s). Analysis of the model's accuracy to predict dropout within the district occurred in the 2017-18 school year. In addition to identifying student risk level, the system flags changes in student results with an arrow to help readily identify changes or patterns in student risk level over time. Bozeman High School staff devote time during data meetings to focus on students at chronic risk, as well as students who have a change in either their EWS risk level status or at least one early warning indicator.

System Use

Implementing the Montana EWS has started important conversations within Bozeman School District #7. High-risk students are typically already known to support staff and administrators, and the Montana EWS data have helped identify students before they become high-risk, such as students who are receiving marginal, but not yet failing, grades. This supports early interventions, which are often more successful than interventions that occur late in the student's educational career when the student may be at high risk of dropping out.

Bozeman School District #7 uses multiple strategies to encourage early warning data use. The district data specialist prepares spreadsheets and reports for each school in the district that uses the Montana EWS. School-level teams receive these reports from the central office for use in their intervention programs. Principals, counselors, and MTSS teams are the primary users of the EWS results at the school level. At the district level, the central office data specialist and administrators of the School and Family Engagement—Trauma Informed grant use the Montana EWS data as one metric in determining district success in supporting students.

At Bozeman High School, the data teams review Montana EWS reports and develop an intervention plan for each student identified as at-risk. Regularly scheduled meetings occur every 3-6 weeks and attendance is non-negotiable, meaning that no other activities on a team member's schedule may take precedence over data team meetings. Typically, the data teams review the 30 students who demonstrate the highest level of risk by the Montana EWS, with special attention paid to students with credit deficiencies and students who are new to Bozeman High School. The high school has a list of interventions to help match students with interventions that will best meet the student's needs. A designated member of each data team is responsible for coordinating with all appropriate personnel who will support the intervention plan. For example, if a student has attendance issues, staff will call the student's parent, and the student's attendance data will be shared with a dean for future monitoring. Administration will notify teachers if a student's grades are a concern and when an intervention plan is in place to address academic issues. If a student who is new to the high school is at risk of dropping out, an intern calls their parent(s) or guardian(s) and a check-in postcard is mailed to the student's home.

At Chief Joseph Middle School, Montana EWS data are reviewed by MTSS leadership teams. These teams use key data elements to identify students at risk of dropping out, meet to review and discuss the progress of students and intervention programs, facilitate communication of goals and action steps for counselors and teachers, and define work tasks. Data are disseminated on a need-to-know basis and are also used by building administrators, student services staff, and counselors as a fidelity check of their schoolwide MTSS implementation. The middle school uses a three-tier MTSS to address academics and behavior as part of their participation in Project REAL 2.0, a Montana State Personnel Development Grant. Fidelity checks also include site visits and self-monitoring tools, such as rubrics. The results of the

fidelity checks are used to evaluate the effectiveness of the MTSS and develop action steps to support improved MTSS implementation, sustainability, and use. Students who are identified as at risk are referred for a tier II or III intervention provided within the MTSS framework. At the tier II level, Montana EWS data are used to create problem statements and develop plans to address the problem statement. The tier II team is part of the decisionmaking process. Tier III is a more intensive approach to meeting the needs of at-risk students, and data drive the discussion and decisionmaking process. Intervention plans are developed by teams and/or the school psychologist using a menu of interventions; these interventions include programs, literacy workshops, and math strategies. The Montana EWS has guided a schoolwide effort to increase average daily attendance, as well as identify students at risk of dropping out due to attendance concerns.

Now in its third year of implementation, the district conducted an internal validation of the system in the 2017-18 school year; the analytical model is refined on an annual basis by the OPI. Longitudinal data will show if dramatic changes within the district's student population have occurred over time, if annual seasonal patterns are impacting students, and if students experiencing significant life events or challenges with transitions are inhibited from success. Looking ahead, the district hopes to use what they learn from the Montana EWS to build a similar system to predict middle school success so that elementary school students can receive support and interventions early in their educational career. Additionally, there is a desire for the Montana EWS to be better integrated with the district's SIS to review trends in individual student risk over time.

Lessons Learned

- **Devote adequate time to planning.** The Bozeman School District #7 central office allowed adequate time to verify the accuracy of the Montana EWS data and model before implementation. The additional time devoted to verification was worthwhile, even though the Montana EWS was not available as quickly as users would have preferred. Chief Joseph Middle School also recommended developing a plan for communicating with staff throughout the development and implementation process.
- **Customize approaches.** The district found that a standardized approach may not be useful for schools or students. Bozeman High School found it challenging to assign students to one-size-fits-all interventions, and the central office noted that it was useful to find out what works best for individual schools.
- **Set clear team expectations.** Both Bozeman High School and Chief Joseph Middle School benefitted from clear expectations for team members and team meetings. Chief Joseph Middle School developed MTSS leadership teams and assigned roles to members, including facilitator, timekeeper, data analyst, and recorder. The Bozeman High School data teams have set a clear building-wide expectation that data team meetings take priority over anything else on the schedule. Their regularly scheduled meetings apply a human perspective to the Montana EWS data, which helps add important contextual factors that may not be readily apparent in the data.
- **Use data to support teams.** Both Bozeman High School and Chief Joseph Middle School found the Montana EWS data useful for ensuring students and their data are reviewed in a systematic way, and that data are useful for informing discussions, actions, and interventions.
- **Celebrate successes.** The goal of the Montana EWS is to help students graduate from high school. Bozeman High School staff noted that it is rewarding when students who were at high risk of dropping out are able to get back on track and graduate from high school. Students who are doing well are sometimes recognized with a positive postcard or gift card.

Case Study: Metro Nashville Public Schools, TN

Metro Nashville Public Schools (MNPS) created an early warning system in 2010 as part of a broader commitment to encourage data-informed school improvement across the district. MNPS was interested in adopting sustainable, proven strategies to improve student achievement and graduation rates, but was challenged by a high dropout rate and a high number of discipline incidents resulting in out-of-school suspensions and expulsions. In response to these challenges, the Tennessee Department of Education encouraged the district to systematically use data to identify district, school, and student needs; prioritize actions to improve; and provide targeted interventions to students in need.

Agency Background

Metro Nashville Public Schools serves approximately 86,000 students enrolled in 167 public schools. The adjusted cohort graduation rate is 81 percent. Approximately 42 percent of the district's student population is categorized in the Black or African American racial/ethnic group, while the next largest student groups are the White group (30 percent) and the Hispanic/Latino group (22 percent). Approximately 71 percent of students qualify for free or reduced lunch, 12 percent have an IEP, and 15 percent are English learners. (Source: ED, NCES, CCD, School Year 2015-16; ED*Facts*, School Year 2015-16). *Note: These numbers represent the most recent ED data and do not necessarily reflect the latest district data.*

System Planning and Implementation

The early warning system planning process began when the MNPS Department of Research, Assessment, and Evaluation partnered with the Everyone Graduates Center (EGC) at John Hopkins University (JHU). The Department and Center reviewed 10 years of MNPS data to identify locally valid early warning indicators and thresholds specific to the district. Predictive indicators of student risk of dropping out were identified for students in elementary, middle, and high school. Staff in the Department of Student Support Services were also involved in reviewing how the early warning data would be translated into intervention programs and services for students flagged by the system as at risk of dropout.

At that time, MNPS was implementing a new longitudinal district data warehouse system using Race to the Top grant funding. MNPS IT staff modified and extended a vendor-created technical platform to create the district's data warehouse. These modifications supported the district's need for additional data storage and advanced data analytics for use in data-informed decisionmaking. In 2011, the data warehouse team and IT staff collaborated with Research, Assessment, and Evaluation staff over 2-3 months to develop technical guidelines and requirements for an early warning system in the district data warehouse.

District leadership was supportive of the early warning system and was also made aware of the goals of creating the system. MNPS used resources on early warning systems to ensure that development and use of the district early warning system was informed by best practices. However, there was no formal implementation plan, which slowed the adoption and use of the system districtwide.

Early Warning Indicators, Data, and Analytics

MNPS analyzed its internal longitudinal data and reviewed current research by early warning system researchers to identify and validate its early warning indicators. Research from the JHU EGC and the University of Chicago Consortium on School Research was particularly helpful during the indicator development process. The district's early warning system uses three locally validated indicators: attendance, suspensions, and GPA. These indicators are aligned with the early warning "ABCs": attendance, behavior, and course performance.

All early warning system data are collected as part of the district's regular data collection activities; no new data collections were needed to support the early warning system. All data used in the early warning system are readily available in the district data warehouse and through extracts from the district's SIS. The data warehouse houses the early warning system and its data, and delivers reports to school, district, and community stakeholders. System data are updated nightly with newly reported data, such as attendance and behavior data, which are recorded daily; grades are reported on a quarterly basis. Student records are protected through a custom security model. Access to data is limited by staff role: district staff can access information on all schools within the district; school staff can access information on students within their school; and classroom teachers and staff can access information on students enrolled in the courses they teach.

Early Warning Indicators

- Attendance
- Suspensions
- Grade point average

Early Warning Indicator Data Elements

- Daily attendance, year-to-date
- Number of days suspended
- Quarterly GPA (0-100)

The district's data collection and reporting processes are supported by multiple staff at the school and district levels. Each school is responsible for entering individual student data into the SIS; these data are imported into the district data warehouse nightly. IT staff are responsible for maintaining and expanding the district data warehouse, as well as supporting the development of data reports in response to stakeholder needs. Automated data checks are conducted nightly as the data warehouse receives individual student data from the SIS. The Department of Data Quality and Integrity monitors data accuracy and assists in resolving the root cause of quality issues as they arise. Data quality dashboards and reports are also made available to school and district staff to help staff monitor, identify, and correct errors that impact data quality.

The early warning system uses a multivariate analytical model to assess student risk of dropout; data on each indicator are also reviewed independently. Each indicator has a predefined threshold that flags a student as at-risk. Risk levels are automatically calculated nightly using the most current data available, which enables staff to identify students in need of intervention as soon as possible. Students that are flagged as at-risk are highlighted on data dashboards to help prioritize action and interventions. The Department of Research, Assessment, and Evaluation is responsible for ensuring analytical model validity and providing information and guidance on algorithms and analysis methods. Data warehouse development/IT staff create accurate and meaningful data reports with features that can help stakeholders act on the data. For example, data drill-downs within a dashboard feature of the system enable users to review lists of individual students.

Early warning data reports are often used in conjunction with aggregate datasets and individual student data reports. For example, data on the early warning attendance indicator are disaggregated, interpreted, and used in tandem with other attendance reports that are disaggregated across different factors. Interpreting early warning data in combination with related datasets enriches understanding of the data and can prompt more effective interventions at the student or school level. Major changes in individual student performance that do not flag a student as at risk of dropping out, such as a major decline in assessment performance, are monitored through separate reports and data systems. Positive or negative growth trends across various student achievement measures are monitored through the data warehouse, which reports trends based on different units of time: a reporting quarter, a single school year, or multiple school years.

System Use

The extent to which the system is used districtwide differs between individual schools and departments. While no formal communication plan exists, clear communication and expectations are critical to supporting districtwide use. MNPS communicates information about the early warning system through multiple channels. Information about the early warning system and its indicators are shared with stakeholders at all levels—classroom, school, district, and school board—as well as a limited number of afterschool and community-based programs. Training and system demonstration sessions are provided during team meetings and professional development activities. Training information is tailored to the specific audience's initiatives and work processes to help make the system more relevant to specific stakeholder groups. District data coaches and school intervention staff also share information on the system with the teams and staff with which they work.

The district encourages early warning data use in a variety of ways. Rather than existing as a standalone tool or dataset, the early warning system and its data are a key component of MNPS's districtwide commitment to data use. Data use is embedded in the MNPS strategic plan and promoted through district- and school-level meetings with staff and leadership. School leaders, data champions, and staff from data-focused departments serve as role models for data use within their school and promote the early warning system as a tool that can help solve problems that district leadership care about.

The Department of Student Support Services was an early adopter of the early warning system. Support teams—which include behavior specialists, attendance specialists, family engagement specialists, social workers, psychologists, and others—use the early warning system to manage staff caseloads, identify students in need of intervention, and develop intensive intervention plans. The system helps staff identify students who are at highest risk and prioritize these students for intervention services to ensure that department resources are allocated to supporting students who are most in need of interventions.

The early warning system is also used by staff and administrators at the district and school levels. At the district level, the system helps district leaders understand the extent of student dropout risk across the district. If the system identifies a high number of students as at risk across multiple indicators, district leaders work with individual schools to understand why students are at-risk. At the school level, counselors, staff, and leadership use the system to identify which students in their school are least likely to graduate. Teachers often have a strong understanding of individual student needs and circumstances, which can be helpful when referring at-risk students for specific intervention services.

MNPS has a variety of intervention programs and services to support students who are at risk of dropping out. Families of students who exhibit risk across multiple indicators are now more likely to receive a home visit from family engagement and intervention staff. Many schools have formal partnerships with community-based agencies that work with students on a referral basis. Additionally, many schools have dedicated "intervention periods" during the school day to provide students with services or content that meet individual student needs.

The district's overall commitment to improving data use has supported sustained, incremental improvements to acting with education data at all levels. Maintaining system flexibility and using and leveraging existing resources has enabled

MNPS to adapt to changes, make improvements, and meet stakeholder needs in innovative ways. The early warning system has contributed to this effort by improving the district's ability to identify and provide interventions to students who exhibit risk of dropping out of school, which has improved graduation rates over time. Since the system was first implemented, the Department of Research, Assessment, and Evaluation has twice evaluated the effectiveness of the early warning system to confirm the predictive value of the early warning indicators. The district is currently conducting an analysis of more recent data with JHU EGC to determine cut scores for the off-track (dropout) indicator and a new on-track (college and career ready) indicator. The district plans to analyze National Student Clearinghouse data to validate college readiness indicators. The district also hopes to analyze de-identified data from the state's longitudinal data system that are not currently available to the district, such as labor participation data and data from Tennessee Colleges of Applied Technology, a state-supported college system with 27 campuses.

Lessons Learned

- **Invest in adoption.** MNPS began developing its early warning system in 2010. At that time, early warning systems were not as well-known and widely used as they are today. As an early adopter, the district had minimal external encouragement and resources to support system development and use. MNPS noted that establishing an understanding of the system's purpose and value amongst staff and engaging leadership in supporting system implementation and use might have encouraged broader and timelier adoption of the system in schools across the district.
- **Implementation is an ongoing process.** MNPS's use of early warning data has advanced as changes occur in district staffing, priorities, and programming. MNPS noted that implementation is never complete, as the people and methods for using the early warning system change as the district changes. Identifying ongoing opportunities to leverage all data, including early warning system data, to inform stakeholders is part of this ongoing implementation process.
- **Encourage teacher use.** Teachers are not required to review or act upon the early warning data. The district found that it can be helpful to provide resources that encourage teacher use, such as a toolkit to assist with selecting interventions or communication materials that explain the utility of early warning indicators. The district's instructional coaches also encourage teacher data use by assisting teachers in identifying and accessing data that are useful and relevant to their area of focus.
- **Align programs with priorities.** Early warning indicators can be used to create awareness for and align community programs with district priorities to ensure that community-based organizations provide programs and services that address student and school needs. The Nashville After Zone Alliance (NAZA), for example, evaluated their impact on student behaviors that are monitored through the early warning system. This evaluation found that participation in NAZA contributed to improved student attendance and discipline, both of which reduce student risk of dropout.

Case Study: Wisconsin Department of Public Instruction

The Wisconsin Department of Public Instruction (DPI) created the Dropout Early Warning System (DEWS) during the 2012-13 school year as part of the State Superintendent's Every Child a Graduate initiative. DEWS is a statewide early warning system that identifies students in grades 6-9 who are at risk of not graduating from high school on time (e.g., within four years from the start of grade 9). DPI's goal for DEWS is to support schools as they leverage data to improve student educational outcomes.

DEWS was developed to address five key goals:

- *Early* – The system identifies whether students need intervention early in their educational career.
- *Accurate* – The system accurately identifies whether students need intervention.
- *Transparent* – Predictions and the assignment of risk status are made in a transparent manner.
- *Reproducible* – Predictions are reproducible and do not vary based on changes in the prediction models.
- *Scalable* – System scalability accommodates a diverse array of student and school contexts.

Agency Background

The state of Wisconsin serves approximately 868,000 students enrolled in 2,291 public schools within 472 school districts. The adjusted cohort graduation rate is 88 percent. Seventy-one percent of the student population is categorized in the White racial/ethnic group, while the next largest student groups are the Hispanic/Latino group (11 percent) and the Black or African American group (9 percent). Approximately 39 percent of students qualify for free or reduced lunch, 14 percent have an IEP, and 5 percent are English learners. (Source: Source: ED, NCES, CCD, School Year 2015-16; ED, OESE, School Year 2014-15). *Note: These numbers represent the most recent ED data and do not necessarily reflect the latest district data.*

System Planning and Implementation

DPI research staff initiated the DEWS planning process in early 2012 through the exploration and prototyping of a predictive analytic model. During this process, DPI researchers partnered with the Wisconsin Educational Research Advisory Council—a council of researchers that advises the state superintendent on education research matters—and consulted research literature on early warning systems and predicting high school dropout.

After a viable analytical model was developed, DPI formed a working group to develop and implement the system. The working group included staff and subject matter experts from across the SEA, including DPI's Policy and Budget team, Student Services/Prevention and Wellness team, Data Warehouse team, Special Education team, Office of Educational Accountability, and others. A research analyst on the Policy and Budget team led the system's technical and predictive model development and implementation process. The Student Services/Prevention and Wellness team developed training materials and support documentation that address how LEAs can use DEWS as part of their student intervention programs and systems.

DPI developed DEWS using open source software. The code is available for users and stakeholders to examine how risk scores are calculated, as well as for other education agencies to use in developing their own early warning system. During the system development process, the working group conducted a pilot test to assess DEWS prior to launching the system statewide. Select middle schools across the state participated in the pilot during spring 2013. DPI surveyed participating schools on the usefulness of the system and report formats, how well the system identified students' risk

levels, the value of the interpretive guide and other supporting materials, and the school's likelihood of future use. The survey feedback was used to refine the system and the training support materials prior to statewide implementation.

The working group also created a communication plan, standard presentation materials, and a suite of training tools to publicize the availability of the new system to LEAs. During the summer before DEWS was launched, DPI staff delivered presentations at professional meetings, data retreats, and conferences throughout the state. These presentations reached several stakeholder groups, including principals, school counselors, special education coordinators, Title I coordinators, regional service agencies, and statewide RTI and Positive Behavioral Interventions and Supports (PBIS) networks.

In addition to technical information and interpretive/action guides, DPI emphasized that DEWS was not part of the state's accountability system and that risk assessments were not permanent labels, but rather intended to focus action on those students who are most in need of intervention. To this end, DPI decided to include DEWS scores only on the secure data dashboard system and only at the student level. This decision meant that some of the richer reporting features from the pilot had to be excluded. These user design decisions have impacted the adoption and usage of DEWS by LEAs.

Broad collaboration across the agency was critical to ensuring that the development process produced a system that is accurate, understandable, and useful for practitioners at the district and school levels. Through the involvement of many DPI staff and a substantial commitment from DPI leadership, DEWS was launched statewide in fall of the 2013-14 school year.

Early Warning Indicators, Data, and Analytics

DPI decided to include specific early warning indicators based on the availability of data in Wisconsin's statewide longitudinal data system, internal preliminary analyses of indicator accuracy, and consultation with the research literature on early warning systems. DEWS uses multiple indicators, including attendance, discipline, mobility, test scores, and demographics. These early warning indicators are used to identify students who are at risk of not graduating from high school within four years.

The Wisconsin statewide longitudinal data system is the source for all DEWS data, which influences the inclusion and exclusion of certain indicators and data that are commonly used in district- and school-level early warning systems. For example, course-level data are often included in early warning systems, but since these data are only available for a few years and not of high quality at the state level, they are not included in DEWS. Additionally, all test scores are from statewide accountability assessments, and discipline data are limited to out-of-school suspensions and expulsion and do not include less severe actions, such as in-school suspensions or detentions. DEWS also includes grade-specific school-level characteristic data in lieu of more direct measures of school climate to provide contextual information about the schools that may impact individual student outcomes.

DEWS predictions are calculated based on a statistical model of the associations between on-time graduation and all the individual and school-level indicators for all available cohorts of students who are eligible to have completed (or not) four years of high school. Each year, separate predictive models are produced for each grade level by combining results from 3 to 8 different machine learning algorithms. For example, a current sixth-grader is assigned predictions based on the observed on-time graduation status of previous cohorts of fifth-graders whose observable characteristics are similar to their own observable characteristics from fifth grade.

The use of longitudinal data and grade-specific models maximizes the accuracy of student risk predictions and helps overcome some of the inherent limitations associated with using data from a single school year per student. DPI re-estimates new predictive models each year to ensure that risk score calculations reflect the latest information available in the data. At present, risk scores are calculated for more than 90 percent of all current sixth- through ninth-grade students using data from students' fifth through eighth grade school years. DPI is currently investigating methods for generating risk scores for students who are missing data associated with one or more indicators.

Risk scores are calculated twice each school year in alignment with when DPI receives data for the various indicators: once at the beginning of the school year and once toward the beginning of the spring semester as a new year of data become available. Risk scores may be calculated more frequently in the future as data collections within the state become more automated and real-time. A Policy and Budget team research analyst is responsible for running the model to update risk scores, and the Data Warehouse team's IT staff are responsible for loading the updated scores into the state education data warehouse and secure dashboard system. Automatic reports are integrated into the risk estimation process to check data and model validity. Risk scores go through an additional quality check as they are loaded into the data warehouse. Any errors or issues are addressed before risk scores are posted to the state's secure dashboard system for use by LEAs. LEAs may access risk scores for enrolled students through the dashboard, as well as the risk scores of students who move into their district from another district within the state.

Early Warning Indicators

- Attendance
- Discipline
- Mobility
- Test scores
- Demographics and other indicators

Early Warning Indicator Data Elements

- Attendance rate
- Total days enrolled
- Number of discipline incidents
- Discipline incident type
- Removal type
- Total days removed
- Number of districts attended
- Number of schools attended
- Number of enrollment spells
- English/Language Arts test scores
- Mathematics test scores
- Full academic year indicators
- Disability status
- Economic disadvantage status
- Ever retained-in-grade
- English Learner status
- Gender
- Race-ethnicity

System Use

DPI offers a variety of supports to encourage LEA adoption and use of DEWS. Training materials were initially developed by the DPI working group during pilot testing and are available on the DEWS website (https://dpi.wi.gov/ews/dropout). Through a partnership between DPI and the state's network of cooperative educational service agencies, the WISExplore project team provides training to LEAs on how to use data to inform decisions within a cyclical continuous improvement framework, including how to use and interpret DEWS scores.

DEWS is available for use by all LEAs in the state, but not all LEAs use the system. Many of the largest districts in the state developed their own early warning systems, while other districts use the early warning system that is included as part of their vendor-provided SIS. Many of the smaller districts within the state can readily identify those students who are at risk of not graduating in four years, which also limits the use of DEWS throughout the state.

DPI has taken several steps to increase the use of DEWS scores. A DEWS Action Guide is available on the DPI website, along with other links to specific supports, resources, and interventions aimed at helping students who are at risk of dropping out of high school. The WISExplore project team provides outreach to support DEWS use, often as part of

an RTI or PBIS system. DPI monitors usage of the secure dashboard system and sends announcements to LEAs when updated predictions scores are loaded to the dashboard. DPI also redesigned the dashboard to make it easier to find DEWS predictions and collaborated with REL Midwest to conduct a survey of DEWS awareness and usage in the fall of 2015, 2 years after DEWS was launched statewide.

DEWS is intended to be used by middle and high school principals, as well as school staff who are included in the student intervention process. DEWS risk scores are often used during monthly planning meetings or as part of planning meetings held at the beginning of the school year. These scores help teachers and administrators identify which students are at risk of not completing high school on time and assign those students to specific interventions based on student need. Coupling state-validated predictions with local knowledge of individual student circumstances can help schools provide interventions that will work best for their students.

Since its statewide launch in fall 2013, DEWS scores have been loaded twice per year. DPI periodically receives user feedback and has implemented system updates, improvements, and changes in response. DPI continues to maintain, refine, and improve the system. Looking ahead, DPI plans to use scores from previous cohorts who have had time to graduate within four years to evaluate the accuracy of DEWS predictions and determine whether DEWS has influenced on-time graduation rates.

Lessons Learned

- **Establish agency support.** Broad support from DPI has played an essential role in the success of DEWS. DPI enlisted SEA staff and leaders from across the agency to share information on DEWS with LEAs. Additionally, the WISExplore team is an invaluable resource for training LEAs across the state on how to interpret and act based on DEWS risk scores.
- **Be transparent.** DEWS uses a complex system of grade-specific predictive models. Rather than promoting DEWS as a one-stop solution or flawless system, DPI has found that clearly and objectively explaining the capabilities, limitations, and accuracy of DEWS and its predictions helps encourage LEA trust in the system.
- **In-house system development and maintenance is beneficial for end users.** DPI staff developed and maintain DEWS in-house, which has made it easier for DPI to refine the system, update its prediction algorithms, and modify how risk scores are disseminated to users. This flexibility has also allowed DPI to respond to feedback from LEAs. DPI identified and addressed system issues from pilot users' feedback before the system went live statewide. Additionally, a new college and career readiness early warning system was produced during the 2017-18 school year in response to user feedback.
- **Support each step of the early warning system process.** As an SEA in a local control state, DPI and the WISExplore team are removed from direct interaction with students, cannot compel LEAs to adopt intervention programs, and are unable to develop an early warning system with integrated interventions and intervention monitoring. While these limitations can be challenging, DPI is committed to promoting and building capacity in Wisconsin LEAs as they focus on the data inquiry process and continuous improvement planning.

Conclusion: Lessons Learned From Case Studies

This chapter presented seven case studies that detail the actual experiences of SEAs and LEAs that have implemented, or are in the process of implementing, an early warning system. A summary of the lessons learned from these SEAs and LEAs concludes this chapter, with the goal of helping agencies who are planning to implement, or have already implemented, an early warning system.

System Planning and Implementation

- Secure broad support from staff and leaders across the agency by establishing a common understanding of the early warning system's purpose and value.
- Draw on professional learning communities and the experiences of colleagues to learn about the barriers, strategies, and successes other states and districts have faced in developing, implementing, and using an early warning system.
- Involve individuals from diverse professional backgrounds in planning teams to ensure that early warning data are easy-to-use in analysis, evaluation, and decisionmaking.
- Collaborate with trusted partners to support the system development process and reduce development time and costs.
- Pilot test the system and solicit feedback to ease the system implementation process.
- Consider in-house system development and maintenance, which may make it easier to refine and improve the system based on user feedback.
- Develop a plan to communicate with staff throughout the system development and implementation process.
- Provide professional development to create awareness and engage stakeholders.
- Share information about the system prior to implementation to help build anticipation amongst stakeholders.
- Think of implementation as an ongoing process, not a one-time activity.
- Prepare for the system to evolve as changes occur in agency staffing, priorities, and programming.

Early Warning Indicators, Data, and Analytics

- Budget a sufficient amount of time to develop the system's analytical model.
- Balance analytical model complexity and transparency.
- Verify the accuracy of the early warning analytical model and data prior to implementation.
- Clearly and objectively explain to users the capabilities, limitations, and accuracy of the analytical model and its predictive abilities.

System Use

- Promote and build capacity for data inquiry and continuous improvement planning.
- Provide appropriate training at opportune times to help early warning system users understand the effectiveness of the system, how risk level is assigned, and how the system can be used across the organization.
- Create resources to encourage use, such as a toolkit to assist with selecting interventions or communication materials that explain the utility of early warning indicators.
- Identify ongoing opportunities to leverage all data, including early warning system data, to inform stakeholders.
- Use early warning data to inform discussions, actions, and interventions at the school, district, and state levels.

- Establish an early warning system team to systematically review school-level and student-level early warning data and assess how well current interventions are working for students identified as at risk of dropping out.
- Prioritize regularly scheduled early warning system team meetings and develop responsibilities for each team member.
- Have an early warning system champion in place to help improve the likelihood that the system will continue to be used.
- Support each step of the early warning process by integrating early warning system use with intervention provision, assignment, and monitoring.
- Find out what works best for individual students and schools, and offer customized intervention programs and services that will best meet their needs.
- Work with community partners to align out-of-school interventions with education agency priorities to ensure that community-based programs and services address student and school needs.
- Celebrate student successes, such as recognizing formerly at-risk students when they graduate from high school.

Appendix A: Checklist of Early Warning System Tasks and Activities

There are many operational tasks necessary to effectively plan, implement, and use an early warning system. The following list of activities can assist state and local education agencies (SEAs and LEAs) as they implement a new or improve an existing early warning system. This list is not exhaustive or prescriptive, and agencies should modify the tasks and activities in this process to best meet their needs.

System Planning Tasks and Activities

Form a planning team

- ✓ Include agency representatives from multiple stakeholder groups.
- ✓ Develop roles and responsibilities for individual team members.
- ✓ Determine the purpose, scope, and focus of the system.

Conduct planning activities

- ✓ Conduct a needs assessment to identify agency and stakeholder needs.
- ✓ Engage stakeholders through focus groups, interviews, or public presentations and meetings.
- ✓ Define valid early warning indicators, identify high-quality data, and develop appropriate analytical techniques and procedures.
- ✓ Develop goals and objectives for system planning, implementation, and use.
- ✓ Decide whether agency staff or an external vendor will develop the system.

Identify indicators and data

- ✓ Review research on early warning indicators.
- ✓ Analyze internal longitudinal data for predictive trends and patterns.
- ✓ Identify potential early warning indicators.
- ✓ Select available, valid, and reliable data for each indicator.
- ✓ Validate early warning indicators and develop associated risk thresholds.

Develop an analytical model

- ✓ Design the analytical model.
- ✓ Validate the accuracy of the model's predictive abilities.
- ✓ Document the model's analytical techniques and analysis procedures.

System Implementation Tasks and Activities

Allocate resources

- ✓ Develop a budget that includes a cost-benefit analysis and a projection of staff time necessary for system development, implementation, and maintenance.
- ✓ Assign responsibility for system development/procurement, implementation, and maintenance to appropriate departments and staff.

Develop/refine an early warning system

- ✓ Create a system development plan or request for proposal that includes goals, timelines, and deliverables.
- ✓ Document system requirements and create detailed technical specifications.
- ✓ Establish system security procedures.
- ✓ Align the system with other information systems.
- ✓ Pilot test system quality and usability prior to implementation.

Train staff

- ✓ Create customized training materials to meet agency-specific needs.
- ✓ Provide targeted training to specific departments and/or staff.
- ✓ Schedule staff training before, during, and/or after system implementation.
- ✓ Incorporate the early warning system into training materials and activities on related topics.
- ✓ Ensure that staff protect student privacy and abide by all data privacy regulations.

Collect/import data

- ✓ Abide by all data privacy regulations.
- ✓ Assign data collection/import responsibilities to appropriate departments and staff.
- ✓ Enable automated data imports and quality checks.
- ✓ Establish a systematic data import, analysis, and reporting schedule.

Analyze and interpret data

- ✓ Test data accuracy and quality prior to analysis.
- ✓ Analyze data using the system's analytical model.
- ✓ Interpret system data with related student data.
- ✓ Implement data drill-downs to enable student-level data reviews.

System Use Tasks and Activities

Report and share data

- ✓ Ensure that data reports protect student privacy.
- ✓ Create a communication plan to guide data reporting and sharing activities.
- ✓ Assign responsibility for data reports to appropriate departments and staff.
- ✓ Make early warning data accessible through dashboards, reports, or other data outputs.
- ✓ Disseminate data to specific departments and staff who use early warning data.

Provide intervention programs and services

- ✓ Encourage data-informed discussions and the systematic use of early warning data.
- ✓ Identify opportunities for the system to support current practices, programs, and processes.
- ✓ Promote data use through existing team-based structures and collaborative activities.
- ✓ Align the system with preexisting intervention systems, programs, and services.
- ✓ Assign responsibility for intervention development, assignment, and provision to appropriate departments and staff.

Monitor student progress

- ✓ Monitor students who are receiving interventions.
- ✓ Monitor students who are no longer at risk of dropping out to determine the effectiveness of specific interventions.
- ✓ Evaluate intervention program outcomes.

System Evaluation Tasks and Activities

Evaluate system accuracy and usefulness

- ✓ Evaluate the need for system upgrades during routine system maintenance.
- ✓ Evaluate the system's accuracy in identifying students in need of intervention.
- ✓ Evaluate the system's usefulness in helping staff and stakeholders identify students in need of intervention.

Document stakeholder feedback

- ✓ Develop formal or informal methods of soliciting stakeholder feedback, such as surveys, meetings, or other methods.
- ✓ Solicit stakeholder feedback on the system's usefulness and actionability.
- ✓ Review user statistics, such as login data, to determine the frequency and consistency of system use.

Determine needed improvements

- ✓ Identify needed system improvements.
- ✓ Coordinate with agency staff and/or external partners to determine the feasibility and scope of system changes.
- ✓ Develop a plan for implementing system changes.

Appendix B: Select List of Early Warning Indicators and Data Elements

This appendix provides a list of early warning indicator topics that are commonly used in early warning systems, cross-walked with student-level indicators and related data elements. The indicators listed in table 2 are presented in alphabetical order, not in order of usefulness or power. In some cases, the early warning data would need to be derived or aggregated from the associated data elements.

Many of these elements are not unique to early warning systems, and they may already be in use in existing data systems. While this list includes elements that are used in early warning systems, it does not include a comprehensive list of all possible data elements that could be included in an early warning system. State and local education agencies (SEAs and LEAs) may find this list useful as they build new data systems or expand existing systems to capture data related to early warning indicators.

Indicator Topic	Student Indicators	Related Data Elements
Assessment performance Achievement or performance on an educational assessment, typically a test	Completion of specific assessment(s), such as a college entrance exam Performance on state assessments and college entrance exams as compared to a specific target	National percentile rank on grade-level assessments Performance on formative assessments or diagnostic tests Performance on school, district, and/or state assessments Performance on domain-specific and/or standards-based assessments Scores on diagnostic assessments
Attendance Attendance in an instructional program approved by the state, district, and/or school	Attendance rates, including daily attendance and course attendance, as measured against chronic absenteeism thresholds that are aligned with school, district, and/or state thresholds	Absences in the previous 60 days Absences in the previous 90 days Aggregate daily attendance Aggregate daily membership Attendance rate Chronic absenteeism Total days enrolled
Behavior Negative or inappropriate behavior that results in a disciplinary action	The number and frequency of discipline incidents	Discipline incident type Number of behavior events in the previous 120 days Number of discipline incidents Number of discipline referrals Number of suspensions (in-school and out-of-school) Number of in-school suspensions Number of out-of-school suspensions Removal type Total days removed

Indicator Topic	Student Indicators	Related Data Elements
Course performance Academic achievement or performance across all courses or a select set of courses	Grade point average Number of courses with grades = F	Common course code, section, year taken, and teacher of record Course grades Course failures Credits earned per year Grade point average Number of previous term A's Number of previous term F's Participation in accelerated learning programs, such as Advanced Placement (AP), dual enrollment, International Baccalaureate (IB), honors, etc. Participation in basic programs, such as English learners, gifted and talented, special education, etc.
Mobility Geographic movement between states, districts, and/or schools	Geographic movement between states, districts, and/or schools Number of times a student changes schools	Grade of entry Military connectedness Mobility during current school year Mobility from out of state Number of districts attended Number of enrollment spells Number of schools attended Transient status
Progression On-time advancement to the next level or grade in an instructional program	Courses completed toward meeting diploma requirements or courses needed/pending (used to help measure whether the student is on track to graduate) Over-age status (is the student older than the average age for his or her grade?) Percentage of total needed credits earned to date Retention (whether a student has been retained in a grade or not)	Accrued high school credits Age difference from peers Cohort graduation year Ever retained in grade Number of years in high school On-track status to graduation Repeating a grade in K-8 Retained designation

Table 2. Select list of early warning indicators and data elements

In addition to data related to specific early warning indicators, early warning systems may include the following types of general student data:

- Identification data, including name and student identifier
- School enrollment data, including LEA and school identifiers, as well as entry and exit dates

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