National Forum on Education Statistics

Using Education Indicators: A Forum Guide for State and Local Education Agencies

National Forum on Education Statistics

Using Education Indicators: A Forum Guide for State and Local Education Agencies

National Cooperative Education Statistics System

The National Center for Education Statistics (NCES) established the National Cooperative Education Statistics System (Cooperative System) to assist in producing and maintaining comparable and uniform information and data on early childhood, elementary, and secondary education. These data are intended to be useful for policymaking at the federal, state, and local levels.

The National Forum on Education Statistics (Forum) is an entity of the Cooperative System and, among its other activities, proposes principles of good practice to assist state and local education agencies (SEAs and LEAs) in meeting this purpose. The Cooperative System and the Forum are supported in these endeavors by resources from NCES.

Publications of the Forum do not undergo the same formal review required for products of NCES. The information and opinions published here are those of the Forum and do not necessarily represent the policy or views of NCES, the Institute of Education Sciences (IES), or the U.S. Department of Education (ED).

December 2022

This publication and other publications of the Forum may be found at the websites listed below.

The NCES Home Page address is http://nces.ed.gov

The NCES Publications and Products address is http://nces.ed.gov/pubsearch

The Forum Home Page address is http://nces.ed.gov/forum

This publication was prepared in part under Contract No. 91990021F0031 with Quality Information Partners, Inc. Mention of trade names, commercial products, or organizations does not imply endorsement by the U.S. government.

Suggested Citation

National Forum on Education Statistics. (2022). *Using Education Indicators: A Forum Guide for State and Local Education Agencies* (NFES 2022132). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Technical Contact

Ghedam Bairu

(202) 245-6644

ghedam.bairu@ed.gov

Foreword

The Forum is pleased to present *Using Education Indicators: A Forum Guide for State and Local Education Agencies*. The purpose of this new resource is to provide timely and useful information on education indicators, how their collection and use have changed over time, and how agencies use them strategically. This new resource highlights best practices for using indicators, adjustments over time to the collection and use of indicators, shifts in types of relevant indicators, and what possibilities LEAs and SEAs see for the effective use of indicators in the future.

In 2005, the Forum developed the *Forum Guide to Education Indicators* (https://nces.ed.gov/forum/pub_2005802.asp) to help the education community better understand how to appropriately develop, apply, and interpret commonly used education indicators. The resource defines the concept of an education indicator, describes the process of establishing a body of education performance and context indicators, and describes 44 education indicators that were commonly used to measure the status of, or change in, education institutions across the nation.

Since the publication of that resource in 2005, many advancements in education have affected indicators, including changes to data systems (such as improved longitudinal data systems), federal data collections and accountability systems, legislation, mandatory public reporting, privacy protections, and data security. In recent years, some agencies have considered adjusting their approaches to standard practices like attendance and grading, which will influence the use of indicators. Agencies also are considering permanently adopting coronavirus disease (COVID-19) pandemic-related changes to grading standards, graduation requirements, and disciplinary methods, which will affect data comparability. New indicators also have emerged as key sources of information for decision-making. For example, learning modality data that track whether students attend school in person, virtually, or in a hybrid model have become increasingly important as agencies work to understand student learning conditions and outcomes. This resource is not offered as an update or a replacement to the 2005 guide; rather, it is a new resource that is intended to complement and enhance the information in the earlier guide by providing current best practices and information.

Publication Objectives

This resource is intended to:

- explain the purpose and benefits of using education indicators;
- discuss how indicators and their use have changed over time; and
- provide recommended best practices and consider common challenges in creating and using education indicators.

Intended Audience

The primary audience for this publication is staff in local, state, and federal education agencies whose responsibilities include any aspect of collecting, reporting, or analyzing the data used to create education indicators. This audience includes program and data staff, researchers, administrators, policymakers, and others who are tasked with using education indicators to improve student and school outcomes.

Organization of This Resource

This resource includes the following chapters and appendices:

- **Chapter 1** defines the concept of education indicators, discusses why they are important, and describes how they are used to increase student achievement and success.
- **Chapter 2** describes the different ways in which schools, LEAs, and SEAs may use particular indicators or groups of indicators.
- **Chapter 3** discusses how the use of indicators has changed over recent decades due to increased data collection and use, changes in technology, and shifts in educational priorities.
- **Chapter 4** discusses common challenges and effective practices related to collecting, reporting, and using the data that form the basis of education indicators.
- **Chapter 5** features case studies from education agencies about their use of education indicators, challenges experienced, and lessons learned.
- **Appendix A** includes examples of LEA and SEA indicator categories.

National Forum on Education Statistics

The work of the Forum is a key aspect of the Cooperative System. The Cooperative System was established to produce and maintain, with the cooperation of the states, comparable and uniform education information and data that are useful for policymaking at the federal, state, and local levels. To assist in meeting this goal, NCES within IES—a part of ED—established the Forum to improve the collection, reporting, and use of elementary and secondary education statistics. The Forum includes approximately 120 representatives from state and local education agencies, the federal government, and other organizations with an interest in education data. The Forum deals with issues in education data policy, sponsors innovations in data collection and reporting, and provides technical assistance to improve state and local data systems.

Development of Forum Products

Members of the Forum establish working groups to develop guides in data-related areas of interest to federal, state, and local education agencies. They are assisted in this work by NCES, but the content comes from the collective experience of working group members who review all products iteratively throughout the development process. After the working group completes the content and reviews a document a final time, publications are subject to examination by members of the Forum standing committee that sponsors the project. Finally, Forum members review and formally vote to approve all documents before publication. NCES provides final review and approval before online publication. The information and opinions published in Forum products do not necessarily represent the policies or views of ED, IES, or NCES. Readers may modify, customize, or reproduce any or all parts of this document.

Working Group Members

This online publication was developed through the Cooperative System and funded by NCES within IES—a part of ED. The Education Indicators Working Group of the Forum is responsible for the content.

Chair

Susan Williams,* Virginia Department of Education

Members

Laura Boudreaux, Louisiana Department of Education

Dena Dossett, Jefferson County Public Schools (KY)

Michael Gerszewski,* Bismarck Public School District (ND)

Will Goodman,* Boise School District (ID)

Thomas Howell, Michigan Center for Educational Performance and Information

Peggy Jones,* Pasco County Schools (FL)

Letitia Linville,* Ohio Department of Education

Zenaida Napa Natividad, Guam Department of Education

Melanie Stewart,* Milwaukee Public Schools (WI)

Laia Tiderman, formerly of the Maryland State Department of Education

Consultant

Bridget Thomas, Quality Information Partners

Project Officer

Ghedam Bairu, National Center for Education Statistics

* Working group members marked with an asterisk also contributed case studies or real-world examples to this guide.

Acknowledgments

The Education Indicators Working Group would like to thank everyone who reviewed or otherwise contributed to the development of *Using Education Indicators: A Forum Guide for State and Local Education Agencies*, including the following:

Reviewers

Allen Miedema, Northshore School District (WA)

Raymond Martin, Connecticut State Department of Education

Case Study/Vignette Contributors

Casey Bertram, Marilyn King, and Mike Van Vuren, Bozeman School District #7 (MT)

Gregory D. Carlson, North Dakota University System

Tracy Famias, Andrea Seibel, and Michael Yantes, Bismarck Public School District (ND)

Ryan Gravette, Idaho Digital Learning Alliance

Alvin Larson, Meriden Board of Education (CT)

Ross K. Roemmich, North Dakota Department of Public Instruction

Contents

Chapter 1: Introduction

What Is an Education Indicator?

An education indicator measures the status of, or change in, an educational system with regard to its goals. Indicators are composed of data elements that are meaningfully and mathematically combined to measure and describe the status or change. Examples include class size, graduation and completion rates, and teacher retention rates.

Indicators can be conceptualized in different ways. One way is to consider three types of indicators: cohort (those that follow and describe a particular group over time), annual (those that measure variables each year), and longitudinal (those that connect a measure across years for a particular group). Understanding the time frame covered by particular data is critical when using them as indicators.

Another perspective is to consider "leading" versus "lagging" indicators. Leading indicators provide a forward-looking view of key education measures, such as third-grade literacy rates as predictors of later success. Lagging indicators address an issue retrospectively, such as assessments or outcome data that measure the effectiveness of previous instruction.

Leading indicators are formative and often function within a shorter time frame than lagging indicators. One can think of leading indicators as those involved in planning, whereas lagging indicators are retrospective. For example, the number of courses in a subject is leading and achievement is lagging. It also is possible that the same data points could be used as either leading or lagging indicators, depending on how they are measured and used. Although attendance is an outcome measure, it also can be used as a relevant leading indicator.

Using leading and lagging indicators in combination can provide actionable data to help inform decision-making. For example, examining the correlations between the leading indicator ninth-grade on track and the lagging indicator graduation rates can identify the need for early interventions that can support student success. Creating and publishing these types of indicators also can spur change at the local and state level.

Although many education indicators emerged from accountability requirements, many agencies have shifted toward using indicators for strategic planning and continuous improvement. Indicators may be perceived as representations of past data, but they also can be forward looking and used to guide an agency's future. Education indicators drive other parts of educational progress, and this kind of "moving the needle" takes time. Indicators often are read from an agency's particular perspective; that is, local, state, and federal agencies focus on indicators differently depending on use cases, time frames, and sector needs. However, agencies also need to consider the overarching goals of the larger education field. As the use

of education indicators for decision-making and program planning continues to expand, more categories of indicators, as well as specific indicators themselves, will need to be discussed and created by education-focused teams of policy analysts, practitioners, and data analysts.

Why Education Indicators Matter

Education indicators are critical to multiple areas of agency activities. They allow agencies to monitor student achievement and goals, identify gaps in student performance for potentially vulnerable populations, and evaluate the effectiveness of new policies and practices. Indicators inform important analyses, such as benchmarking, comparing groups, and assessing the benefits of funding allocations. They can offer greater transparency to stakeholders by providing easily accessible information and offering a means of clearer communication.

Education agencies use indicators for varied strategic purposes. For example, districts trying to fill course vacancies need workforce and staff data about teachers, such as certifications or professional development, to help ensure effective placement. By providing shared metrics across the education system, indicators also help increase stakeholder understanding and lay the foundation for tools such as crosswalks to state report card data.

Because a single assessment, such as a final exam score, rarely yields a complete picture of a student's learning, indicators that use multiple measures and multiple types of assessment help teachers and schools realize a more complete picture of an individual student's needs. This picture helps educators better allocate limited intensive intervention resources. Indicators also often are used to allocate resources and help direct (or redirect) funds for students and staff.

At the classroom level, indicators can help teachers personalize instruction for groups and individuals. By collecting a range of data, analyzing them, and giving them to classroom teachers, agencies support their educators as they address specific student needs and make data-informed decisions to improve learning.

> During the coronavirus disease (COVID-19) pandemic, many existing indicators were adjusted or new ones added to meet shifting data needs. Additionally, agencies have grappled with how to collect and use data for indicators that will not be comparable to prior years.

Many advancements in education have impacted indicators, including changes to data systems (such as improved longitudinal data systems), federal data collections and accountability systems, legislation, mandatory public reporting, privacy protections and data security. In recent years, some agencies have considered adjusting their approaches to standard practices like attendance and grading, which will influence the use of indicators. Agencies also may consider making temporary changes in response to major events (such as those related to the coronavirus disease [COVID-19] pandemic) permanent. Formalizing these types of changes to indicators related to grading standards, graduation requirements, or disciplinary methods will affect data comparability. New indicators also have emerged as key sources of information for decision-making. For example, learning modality data that track whether students are attending school in person, virtually, or in a hybrid model have become increasingly important as agencies work to understand student learning conditions and outcomes.

As the design and use of education indicators shift with agencies' changing needs, advances in technology, and outside influences, many data experts have noted the need for a wider range of measures, including those that would address issues like social-emotional learning, engagement, expectations of teachers, rigor of assignments, alignment with grade level, and educator practices.

Using Education Indicators to Benefit Students and Educators

In recent decades, agencies have made many changes in their collection and use of education indicators, but the central purpose has remained the same: to benefit students and educators. Advances in data practices and technology have allowed for greater data precision, accuracy, timeliness, agility, actionability, and access. For example, Bismarck Public School District (ND) provides indicator information as close to real time as possible through a data system that intakes student rosters and assessment scores nightly and updates calculations for the district's multi-tiered system of support (MTSS) and early warning signs indicator. Jefferson County Public Schools (KY) sends reports to school leaders every 6 weeks that allow them to review key indicators, identify potential red flags, and follow up with discussions about improvement strategies and support needed from the central office. Giving schools access to common data points, rather than requiring them to submit a request, has increased the use of the data and bolstered efforts for improvement.

Indicators can encourage educators and administrators to look more broadly at which conditions and inputs help student learning. They then can use the actionable information provided by indicators to make decisions that benefit students and improve student outcomes. Providing decision-makers with convenient access to indicators also has increased transparency, and therefore trust, for many agencies. Both internal and external stakeholders are more able to:

- comprehend student progress over time;
- see potential imbalances between groups;
- observe the influence of data on teacher practices;
- access multiple sources of data in one place;
- assess school finance decisions and resource allocation;
- see the impact of educator professional development; and
- understand different levels of accountability data.

As the use of education indicators evolves and the data systems supporting them improve, education-focused teams of policy analysts, practitioners, and data analysts also need to address issues arising from earlier practices and data decisions. Although recent data may be accurate, current plans for indicators need to account for historical complications such as data anomalies, changing data definitions, unavailable or low-quality data, or outdated data systems and assessment scales. These concerns all can influence the comparability of data and the validity of longitudinal analyses.

Chapter 2:
Different Ways Agencies Use Education Indicators

Chapter 2 describes the ways that education agencies at the local, state, and federal levels may use particular indicators or groups of indicators.

Using Education Indicators Across Educational Levels

Schools, local education agencies (LEAs), and state education agencies (SEAs) across the country have wide-ranging uses for education indicators. They may be used to:

- identify individual students' needs or gaps among groups;
- inform multi-tiered systems of support (MTSS) or early warning systems;
- target specific interventions;
- evaluate the success or effectiveness of implemented programs;
- identify disciplinary concerns;
- establish benchmarks across districts and states;
- evaluate achievement on state or national assessments;
- provide the data for public reporting;
- forecast college or career readiness;
- evaluate educator preparation and effectiveness; and
- project the future of the workforce or economy.

Education indicators also are crucial to evaluation and decision-making at the national and international levels. They are used to evaluate cohort rates by providing a comparable indicator across states. For example, the Council of Great City Schools has academic and operational Key Performance Indicators that are collected annually and analyzed. The indicators are then published with anonymous codes so that users cannot identify other locations but still can use the information for benchmarking. Additionally, indicators drive international assessments such as the Trends in International Mathematics

Examples of International Assessments and Indicators

Trends in International Mathematics and Science Study (TIMSS): Since 1995, TIMSS has monitored trends in mathematics and science achievement every 4 years, at the fourth and eighth grades. TIMSS 2019 was the seventh assessment, providing 24 years of trends. https://nces.ed.gov/timss/

Program for International Student Assessment (PISA): PISA measures 15-year-olds' ability to use their reading, mathematics, and science knowledge and skills to meet real-life challenges. https://nces.ed.gov/surveys/pisa/

Progress in International Reading Literacy Study (PIRLS): PIRLS is an international assessment and research project designed to measure reading achievement at the fourth-grade level, as well as school and teacher practices related to instruction. https://nces.ed.gov/surveys/pirls/

and Science Study (TIMSS), the Program for International Student Assessment (PISA), and the Progress in International Reading Literacy Study (PIRLS).

Some indicators are used across agency levels in ways that are appropriate to each. For example, classroom teachers monitor attendance data to determine whether there are patterns in students' absences that call for intervention and to adjust lesson plans when needed. At the school level, principals and school leaders monitor schoolwide attendance data to determine whether changes and interventions are needed to promote consistent attendance. LEAs report school and LEA attendance rates as part of their accountability data and often share attendance information on the data dashboards that house their school- and LEA-level report cards. Both LEAs and SEAs are required to report chronic absenteeism data for federal reporting. SEAs are obligated to follow the requirements of state truancy laws, and many provide information about chronic absence data on their state report cards. At the federal level, the U.S. Department of Education uses chronic absenteeism data reported by LEAs and SEAs to promote an understanding of patterns and trends in absenteeism at the district, state, and national levels. Thus, each level works with the attendance indicator, but the particular uses and ways the data are presented to stakeholders vary by agency purpose and goals.

Using Education Indicators for Data-Informed Decision-Making

Education indicators are critical parts of the data-informed decision-making process. Indicators allow agencies to make relevant comparisons, show the impacts of policies or practices, identify levels and types of need, and demonstrate strengths and weaknesses. Leaders in Milwaukee Public Schools (WI) have seen an increase in transparency to internal stakeholders and the public as they used information drawn from indicators to make key decisions. In Pasco County Schools (FL), leaders use data indicators to identify needs and goals in their strategic plan, determine supports for schools for the coming year, and measure progress toward goals.

Best practices for developing and using indicators for decision-making include:

- ✓ focus on the indicators most relevant to a query;
- ✓ use indicators that are research or evidence-based;
- ✓ ensure high-quality data are current and used for appropriate purposes; and
- ✓ update reporting and data visualizations to reflect changes.

The *Forum Guide to Taking Action with Education Data* (https://nces.ed.gov/forum/pub_2013801.asp) 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, LEAs, and SEAs.

Communicating Indicators Among Agencies

Sharing indicator data across different education levels expands the data's usefulness. Linking indicator data that are used at different levels also can clarify the purpose, use, and importance of the indicator. For example, absenteeism indicators are featured in federal report cards, state report cards, and LEA strategic plans. Agencies should develop clear and mutually beneficial data-sharing agreements with their counterparts to minimize complications. Interagency communication has an additive value; for example, LEAs may not be able to connect absenteeism data to postsecondary success indicators, but an SEA can offer crucial context that enables those connections. Frequency and availability are important considerations, as a lag in data reporting and sharing between agencies can affect the timeliness and actionability of data. For education indicators to be truly useful, agencies need to know what indicator data are available and how to access them.

Agencies need to convey key information to varied audiences and communicate indicators in ways that stakeholders will understand. Providing clear definitions of concepts that are measured by indicators, such as graduation rate, can help in this regard. Metadata, common data standards, and data dictionaries increase transparency, enable interoperability, and explain the components that make up an indicator. The *Forum Guide to Metadata* (https://nces.ed.gov/forum/pub_2021110.asp) provides examples of standard metadata items and definitions to assist agencies with standardization. The *Forum Data Visualization Online Course Module 2* (https://nces.ed.gov/forum/dv_course.asp) addresses how to communicate indicators among different stakeholder groups, including:

Forum Data Visualization Online Course
https://nces.ed.gov/forum/dv_course.asp
This online course is designed to help education agencies communicate data meaning in visual formats that are accessible, accurate, and actionable for a wide range of education stakeholders. It is based on the *Forum Guide to Data Visualization: A Resource for Education Agencies* (https://nces.ed.gov/forum/pub_2017016.asp). This course is intended for staff in local, state, and federal education agencies whose responsibilities include any aspect of analyzing data or sharing meaning through data with education stakeholders.

- teachers;
- administrators;
- school board members and special groups at the school board level;
- researchers and partners;
- families, including parents and guardians;
- students; and
- community members.

Chapter 3:
Changes in the Use and Classification of Education Indicators Over Time

Chapter 3 discusses how the use of indicators has changed over recent decades due to increased data collection and use, changes in technology, and shifts in educational priorities.

Changes in Education Indicators and Processes

As the use of education indicators has diversified and expanded over time, some agencies have changed the indicators themselves. For example, the Louisiana Department of Education's discipline indicator has evolved from tracking solely in- or out-of-school suspensions or expulsions to including alternate site suspensions and expulsions. These adjustments accommodate changes in how students are disciplined. In Virginia, perspectives on discipline data have shifted to consider student behavior as a form of communication for which an administrative response could include a behavioral intervention or instructional support in addition to or in lieu of a disciplinary sanction.

Bismarck Public School District (ND): Improving Processes

For decades, Bismarck Public School District's (ND) data team produced a spreadsheet of student test scores each trimester to share with schools. If a teacher did not complete the tests or input the scores for some students on time, those students' test data were not included.

The district adopted new technologies (piloted in 2014-2015 and implemented in 2015-2016) that allowed it to produce a placement report using a data warehouse, fed nightly with data from assessment loads and enrollment information. The data warehouse now produces the indicator information based on the configured rules with more timely data in an automated system.

Agencies also have updated their processes for collecting and using indicators. In Milwaukee Public Schools (WI), data leaders report that tasks that once required greater effort have been streamlined, automated, and made routine. Over time, these adjustments have given the district more data in a faster timeframe, more continuity in education metrics between districts and the state, and increased data accuracy and quality. Pasco County Schools (FL) also has seen improved access to indicators. Digital access has allowed the district to produce data visualization dashboards that users can interact with to answer specific questions.

In the Maryland State Department of Education, indicators have become increasingly multidimensional. Many of the indicators that the state used 20 years ago relied on a single data point from a single level, such as the attendance rate for all students. State leaders have seen growing acceptance for using education indicators together in order to create a comprehensive picture. For example, attendance rate is disaggregated by student groups and at the local education agency (LEA) and school levels, and it also is used in combination with chronic absenteeism. Similarly, Boise School District (ID) has moved beyond collecting and using

indicators mainly to complete state reporting requirements and now works with indicators that are useful at the classroom, building, and district levels to help guide instruction.

Other agencies have adjusted how they produce and disseminate education indicators. In Bismarck Public School District (ND), data teams are using the same types of indicators as in the past, but the components have changed. For example, the multi-tiered systems of support-academic (MTSS-A) indicator components have changed as some national assessments were discontinued and new assessments were implemented. In addition, some standards-based components were phased out in favor of curriculum-based national assessments, and processes for the administration of assessments also have become more standardized. In Jefferson County Public Schools (KY), many indicators have not changed significantly over the years, but stakeholders have requested more frequent updates of key data points. The district now produces 6-week "vital signs" data reports and offers several data dashboards that provide real-time data for schools.

Influences of Policy and Education Indicators

Education indicators can influence policy decisions, such as when they are used to demonstrate funding gaps or instructional needs. In Louisiana, the state education agency (SEA) shares education indicators with legislators and the state board of education to draft new policies, adjust existing policies, and evaluate the effectiveness of programs and policies.

Policy decisions also can influence education indicators. For example, state legislatures may direct agencies to collect (or to stop collecting) particular data. In 2020, during the coronavirus disease (COVID-19) pandemic, Virginia issued one-time emergency waivers for some graduation requirements, which affected the graduation rate for that year; many other states took similar action. In light of the increased societal focus on bullying in schools, Louisiana instituted legislation that requires the SEA to report on bullying.

The Ohio Department of Education focuses primarily on state-legislated metrics when communicating education performance to the public. Within the past decade, the state legislature has instituted major changes to education indicators, including changes in graduation requirements and a complete reorganization of the state accountability (report card) system. Additionally, in response to the COVID-19 pandemic, the state legislature introduced flexibility for graduation and third-grade promotion requirements. As a result, longitudinal education indicators often lack stability.

In the Louisiana Department of Education, agency goals change as administrative priorities evolve. As those agency goals change, the SEA's focus shifts among different groups of education indicators. For example, a past agency goal was to have students enter the fourth grade on time and on level. The education indicators were achievement at fourth grade, as well as grade retention. Grade retention has not been a recent focus for Louisiana leaders due to research indicating that grade retention has mixed results. Some recent new indicators in Louisiana are focused on the agency's goal of quality early childhood centers. These indicators were created to measure the quality of early childhood centers, classroom observations, and student literacy screening.

In Idaho, policy decisions can be based on the data collected through state requirements. Outside the legal requirements for state and federal data collections, the media use many of the education indicators that the SEA collects in their news articles, which often help drive public policy at the school board, district, and state levels.

Advances in Statewide Longitudinal Data Systems (SLDSs) and Technology

> More sophisticated data systems allow agencies to automatically upload data overnight, or at other regular intervals, instead of having local education agencies (LEAs) create reports from raw data and submit them through a reporting system. Additionally, a teacher administering an assessment can give students, parents, school administrators, and other stakeholders immediate access to results. Data systems allow agencies to validate education indicators daily and monitor accuracy, improving the quality of education data.

Over the past several decades, state data systems have grown to include student data over time, improved technology, and expanded data use. This growth has had important effects on education indicators, allowing them to provide more accurate, timely, and targeted information to improve education. As of fiscal year 2019, the U.S. Department of Education has provided more than $800 million in funding to states to support their SLDSs.[1] States have developed SLDSs to include unique records for all students statewide, integrate data across K-12 programs, and connect K-12 education data with data from early learning programs, postsecondary institutions, and beyond. In more recent years, SLDS development has focused on data use and providing longitudinal data about students to schools and LEAs.

Modern data management systems have made it possible to quickly report student education indicators at the classroom level, which allows teachers to better individualize instruction, target student learning needs, and create better learning plans for their students. Education indicators also help agencies make decisions about how resources are allocated and ensure that programs and curricula have the greatest impact.

> Selecting the right software to compile and share data is vital. Software unaligned to district needs can lead to lost instruction, time, and resources. The *Forum Guide to Technology Management in Education* (https://nces.ed.gov/forum/tech_management.asp) addresses the widespread use and integration of technology in modern education systems and focuses on technology governance and planning, technology implementation, integration, maintenance, support, training, privacy, security, and evaluation.

The Ohio Department of Education has had a robust data reporting and warehousing system since the early 2000s. There are very clear reporting requirements and quality assurance processes to collect data consistently. Data leaders are beginning to rely on visual analytics platforms to display data to users in a variety of new ways. The SEA develops public-, school-, and district-based reports for use in analytics, data quality, and data-driven decision-making. Although the current system leverages current and historical data, in time the data team will be able to incorporate predictive analysis into its toolset for the state's agencies.

Due to the high volume of student-level data in mature longitudinal data systems, agencies need consistent rules for data collection. Data provide a snapshot in time that is affected by data sources, timelines for collection, and other factors. Metadata, defined most simply as "data about data," are structured information that provide the context in which to interpret data.[2] The *Forum Guide to Metadata* (https://nces.ed.gov/forum/pub_2021110.asp) presents and examines how metadata can be used by education agencies to improve data quality and promote a better understanding of education data.

1 Statewide Longitudinal Data Systems Grant Program. (2020). *History of the SLDS Grant Program: Expanding States' Capacity for Data-Driven Decisionmaking*. U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved September 22, 2022, from https://slds.ed.gov/#communities/pdc/documents/16862.

2 National Forum on Education Statistics. (2021). *Forum Guide to Metadata* (NFES 2021110). U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved January 27, 2022, from https://nces.ed.gov/forum/pub_2021110.asp.

Chapter 4:
Common Challenges and Possible Solutions in Using Education Indicators

Chapter 4 discusses common challenges and effective practices related to collecting, reporting, and using the data that form the basis of education indicators.

Avoiding Potential Misuses or Misinterpretations

As education agencies make data more transparent and accessible to multiple stakeholder groups, the possibilities for misuse or misinterpretations increase. Stakeholders are not necessarily experts in indicators or statistics, and agencies' best efforts to translate and clearly communicate data may not always be enough. In Pasco County Schools (FL), data leaders realized that as teachers and other staff became more involved in discussions about indicators and the information they provide, releasing too many indicators at once could overwhelm staff and make them less likely to use the indicators due to concern over misinterpretations.

Forum Guide to Data Ethics
http://nces.ed.gov/forum/pub_2010801.asp
While laws set the legal parameters that govern data use, ethics establish fundamental principles of "right and wrong" that are critical to the appropriate management and use of education data in the technology age. This guide reflects the experience and judgment of seasoned data managers; while there is no mandate to follow these principles, it is hoped that the contents will prove a useful reference to others in their work.

Forum Guide to Data Ethics Online Course
https://nces.ed.gov/forum/dataethics_course.asp
This online course is based on the *Forum Guide to Data Ethics* and focuses on how ethical principles apply to education data. It is intended for any person who handles data in an education organization, including superintendents, chief information officers, principals, teachers, registrars, counselors, school board members, data managers, technology directors, information systems staff, data stewards, technical staff, office staff, paraprofessionals, volunteers, and vendors.

Protecting the privacy of student and staff data always needs to be considered when developing and using indicators, such as when an indicator uses student race and ethnicity subgroup data. As data are disaggregated into subgroups, there may be instances of small cell sizes that need to be suppressed in accordance with privacy rules, resulting in a key data point like dropout rate being masked. The underlying, disaggregated data may represent a small number of students and require suppression from reports to ensure that students are not identifiable. Sensitive data like dropout data may contain so few students in subgroups that complete redaction from reporting sites is necessary to comply with federal privacy laws.

At the same time, too much clustering can eliminate details. Using the same example of race and ethnicity data, an education indicator for a group of students defined as "two or more races" may not be useful because the defining characteristic of the students in the group is too varied. Data about each race may be lost, or differences in students of various races may not be seen.

Many agencies work to find a balance between not suppressing data due to small cell counts and not losing information when students are grouped too broadly.

Finally, rounding rules impact districts differently depending on their size. For example, a large district with three high school noncompleters out of a graduating class of 1,000 students may be allowed to round its 99.7 percent graduation rate to 100 percent, while a small, rural district with three noncompleters might not be able to round its graduation rate the same way. The *Forum Guide to Collecting and Using Disaggregated Data on Racial/Ethnic Subgroups* (https://nces.ed.gov/forum/pub_2017017.asp) identifies some of the overarching benefits and challenges involved in data disaggregation, recommends appropriate practices for disaggregating racial/ethnic data in districts and states, and describes real-world examples of large and small education agencies disaggregating racial/ethnic data successfully.

Indicators and the data underlying them also can be misunderstood or taken out of context by various stakeholders. In the Louisiana Department of Education, every kindergarten student must take a literacy screener before October 1. This information is intended to help schools identify students with literacy needs, but it is presented via a legislative report that can be misinterpreted by those not familiar with the purpose of a screener. Agencies must consider potential misuses when designing reports and sharing indicators. Stakeholder data literacy is an important consideration for local and state education agencies (LEAs and SEAs), especially as the need for real-time, actionable data has increased. Agencies need to convey to data requestors that data change over time and will not be static across a school year.

> Milwaukee Public Schools (WI) convened a work group to review how the district shares metrics with stakeholders who may not understand the calculations involved and assume the metrics are faulty. For example, when stakeholders did not understand why student grades did not match standardized test scores (such as a "proficient" rating on the report card and a "basic" score on the state test), the data team discussed ways to provide comprehensible, transparent information about the differences between the data points and how they are collected.

Facing similar challenges, the Ohio Department of Education has tried to mitigate misunderstandings by supplying clear documentation of business rules in calculations, data caveats, and targeted suggestions. The SEA has an internal committee of data experts, communications staff, and legal staff that reviews data requests and determines the best approach to meeting the internal or external requestor's goals, which sometimes means denying the request. The SEA also has a separate data governance committee consisting of agency leaders that reviews any new data leaving the agency to ensure that the data are accurately compiled and accompanied by appropriate methodological documentation and communication strategy.

Data leaders should carefully consider data ethics when creating and working with education indicators. Possible unintended implications or consequences, as well as questionable use of indicators to influence interpretations, all should be important parts of the discussion. The *Forum Guide to Data Ethics* (http://nces.ed.gov/forum/pub_2010801.asp) and *Forum Guide to Data Ethics Online Course* (https://nces.ed.gov/forum/dataethics_course.asp) outline fundamental principles that are critical to the appropriate management and use of education data.

Addressing Completeness and Validity in the Data

Advancing technology and data storage have improved the quality and accuracy of the data held in contemporary data systems and data warehouses. However, agencies still need to have plans for identifying and mitigating the potential damage of missing or incomplete data. These data may be current items that are missing or data from previous years that were not saved.

For example, education agencies across the country felt the impacts of the coronavirus disease (COVID-19) pandemic on data collection. In Wisconsin, data leaders working with the state report card needed to determine how to handle a missing year of achievement data, which presented different challenges from growth data. They calculated achievement indicators using the 3 most recent years of data and omitted the missing year. Calculating growth was more complicated, as the missing year invalidated the typical means of computing the longitudinal indicator. The "skip year" was left out of the growth calculations, and a disclaimer was included on the front page of reports to clarify these adjustments. In Milwaukee Public Schools (WI), explaining the new report card metrics and the impact of COVID-19 on the data was critical so that all stakeholders understood them.

In Ohio, the SEA has a robust system for reviewing data submissions in real time and resolving the majority of missing or incomplete data issues at the time of submission. The SEA also has a team of data managers responsible for checking data submissions for validity, as well as a data quality team that walks administrators through data reporting issues. The SEA's appeals process allows LEAs and schools to appeal inaccurate data submissions, even after reporting ends. The data team continually reviews automatic and manual data checks and offers reporting guidance to ensure that the SEA receives the highest quality data.

During the COVID-19 pandemic, the Ohio Department of Education's data team continued to collect all available data and displayed performance indicators to schools and districts even though most metrics were not made public. This approach gave schools and districts as much information as possible to make internal policy and practice decisions without publicly sharing incomplete data that could be misused or misinterpreted.

Influences of Changes to the Education Landscape

Indicators help educators make more informed decisions as world conditions or localized situations require them to modify learning environments or strategies. Emergency responses, societal shifts, and changes in demographics are examples of forces that could drive education leaders to respond by creating useful indicators. For example, the COVID-19 pandemic led many agencies to consider the potential for learning loss. Some created metrics to measure it and predict later effects. Gaps in data may occur due to changing conditions, such as the number of suspensions dropping nearly to zero in many locations when schools went to remote or hybrid models.

Rapid and frequent changes to indicators sometimes can adversely affect data quality. For example, if data systems cannot be updated quickly to accommodate new changes in indicators, agencies may need to temporarily rely on other systems that do not have as rigorous data quality checks in place. In a sudden unexpected crisis, such as a hurricane or other natural disaster, leaders need to determine how to address and report indicators that may change due to shifting education situations. The *Forum Guide to Planning for, Collecting, and Managing Data About Students Displaced by a Crisis* (https://nces.ed.gov/forum/pub_2019163.asp) provides best practices for collecting and managing data about students in these situations. Ultimately, changes to the education landscape not only may drive interest in particular indicators during a specific time but also could lead to policy changes.

Communicating With Stakeholders About Education Indicators

As noted in the previous section, education agencies need to diligently and effectively communicate information about indicators with different stakeholder groups. Transparency needs to be balanced with accuracy. Data privacy and security also must be ensured when sharing and reporting data. The *Forum Guide to Education Data Privacy* (https://nces.ed.gov/forum/pub_2016096.asp) and *Forum Guide to Cybersecurity: Safeguarding Your Data* (https://

nces.ed.gov/forum/pub_2020137.asp) provide additional details about protecting the privacy and security of agency systems and data.

Data leaders in Milwaukee Public Schools (WI) have found that misunderstandings about data collection can lead to confusion for stakeholders. Indicators such as attendance rate, absenteeism, regularly attending, 30-day attendance rates, and 7-day attendance rates may confuse readers who do not realize that they are based on different time periods. In Michigan, indicators are used to provide transparency to stakeholders via Parent Dashboards and a data access portal targeted to parents and communities, policymakers, the media, and the general public. Each report and set of metrics is accompanied by frequently asked questions and links to metadata associated with the report and encapsulated metrics. Most often, the SEA publishes a summary of data used, their source and collection cycle, and explanations using plain wording to help bring clarity to end users.

Agencies must consider how to build people's capacity to interpret and use indicators while also giving them information in a way that makes it more meaningful and useful. Sudden increases in data can be overwhelming for instructional staff and confusing for parents and community members.

Best Practices for Ensuring the Accuracy, Timeliness, and Efficacy of Data Used for Education Indicators

High-quality data are the foundation for understanding the condition of education. The quality of indicators and their data depend on the effectiveness of the practices and processes that produce them. The *Forum Guide to Building a Culture of Quality Data: A School & District Resource* (https://nces.ed.gov/forum/pub_2005801.asp) identifies four major attributes of high-quality data:

- *Accuracy*. The information must be correct and complete. Data entry procedures must be reliable to ensure that a report will have the same information regardless of who fills it out.
- *Security*. The confidentiality of student and staff records must be ensured, and data must be safe.
- *Utility*. The data must provide the right information to answer the question that is asked.
- *Timeliness*. Deadlines are discussed, and data are entered in a timely manner.

The *Forum Curriculum for Improving Education Data: A Resource for Local Education Agencies* (https://nces.ed.gov/forum/pub_2007808.asp) provides lesson plans, instructional handouts, and related resources, and presents concepts necessary to help schools develop a culture for improving data quality.

By documenting the strengths and weaknesses of their data, education agencies assure that they pay attention to ameliorating the weaknesses, use the data appropriately, and reinforce the credibility of the data and their use. The 2020 Federal Committee on Statistical Methodology report *A Framework for Data Quality* (https://nces.ed.gov/fcsm/pdf/FCSM.20.04_A_Framework_for_Data_Quality.pdf) presents a framework for identifying data quality for all data, summarizes the current state of practice in identifying threats to data quality within each framework component, and provides guidance for promoting effective reporting of data quality.

Checklist of Best Practices and Recommendations

- ✓ Consider the validity and reliability of the source data.
- ✓ Remember that nationally normed data may be better and more consistently collected than a locally scored indicator.
- ✓ Provide clear definitions of rules and scales associated with the source data and indicator.
- ✓ Determine whether the audience for the indicator is clearly defined.
- ✓ Clearly communicate the data elements of the indicator.
- ✓ Collaboratively develop indicators with input from policy analysts, data specialists, and practitioners.
- ✓ Encourage professional learning to increase data literacy.
- ✓ Evaluate education indicators before implementing policies or programs.

Chapter 5:
Case Studies from Local and State Education Agencies (LEAs and SEAs)

Chapter 5 features case studies from education agencies about their use of education indicators, challenges experienced, and lessons learned.

Bismarck Public School District (ND): Using Indicators to Identify Student Needs

With a central goal of using education indicators to help students in need, Bismarck Public School District (ND) (BPSD) uses indicators to identify students who may need additional academic and behavioral support or interventions. The local education agency (LEA) uses data from its multi-tiered system of supports—academics (MTSS-A) and early warning system (EWS) to provide key information. As multidisciplinary teams use these targeted indicators across the LEA, BPSD can flag potential issues, determine the best course of action, and assess the success of interventions on a regular basis.

Creating a Consistent and Precise Process

In the past, BPSD relied on a relatively low-tech system of spreadsheets created with data from the LEA's data warehouse. Data could be calculated using weighted guidelines and percentiles, but the system was improved by formulas that consolidated data into a single point range across grade levels. Beyond this improvement, data leaders realized they needed ways to identify interventions or supports that worked for students, as well as to clarify needs for staff allocation across buildings to support interventions and for staff training.

When considering interventions, BPSD also saw the need to integrate behavioral and academic indicators more deliberately. The data team shares the relevant data with teacher teams to ensure that the indicators are accurately identifying students. In addition to finding that a single standard did not always identify risk accurately, BPSD found that students received more effective interventions and supports when teams of data scientists, school leaders, and teachers collaborated to work with the indicator data.

Changing the process has made it more efficient and allowed school building teams the autonomy to use the indicator data. In the past, these teams had to receive indicator information from the LEA. This involvement also has helped teachers see the connections between the data they upload to the system and the interventions that are ultimately chosen for students.

The increased usability of the data also is a product of the data system's greater speed. Whereas BPSD used to upload data once a week, the data team now can access the updated data every night. This gives teachers access to real-time information, which has modified how they approach assessment and interactions with students. The timeliness of the data means that teachers and administrators can see more quickly whether a particular intervention is working and determine if changes should be made.

Using the same set of indicators across schools and divisions lets stakeholders look at consistent data aligned across different educational purposes. Student and teacher mobility throughout the LEA causes fewer issues, as the same data and indicators are being used in different schools. This consistency allows for stable expectations. BPSD's governance model requires annual reports to the BPSD School Board on specific indicators. This not only serves as a check on the system; it also helps identify overall gaps, staffing needs, and professional development opportunities. Having consistent data and expectations across the LEA has improved problem solving, data-informed decision-making, and deep data dives conducted by multipurpose academic and behavioral teams.

MTSS-A and EWS

BPSD's unique use of indicators brings academic and behavior data together in a single report based on the belief that interventions must consider both areas. The combined report also helps the LEA by offering a 30-day view of indicator data. This timely reporting helps instructional coaches be part of team decision-making and provides fidelity checks against the system's information.

BPSD uses two predominant indicators: the MTSS-A and EWS.

The MTSS-A includes three assessments measuring different curriculum areas or proficiency. Most of the assessments are nationally normed, but the LEA still uses some local standards-based assessments at certain times of the year. Assessments include nationally normed overall reading and math, as well as standards-aligned measures like oral reading fluency, math concepts and application, vocabulary, and spelling. The MTSS-A provides a weighted score based on a standards-based score or national percentile. By aligning Title I identification data with the data provided by this indicator, BPSD can identify students who may be in need with greater accuracy. This model identifies more students, especially those who may need early intervention, than the Title I data alone.

BPSD's EWS initially focused on attendance and externalized behaviors. Over time, it moved to include academic and behavior standard-based scores, Individualized Education Programs (IEPs), academic interventions, internalizing behaviors (reported by teacher nomination), and frequent nurse visits. The current EWS covers students at all grade levels, with the following components:

More information about early warning systems is available in the *Forum Guide to Early Warning Systems* (2018): https://nces.ed.gov/forum/pub_2019035.asp

- All levels
  - Weighted points-based score by category
  - Attendance
  - Discipline logs, incidents, and consequences (such as out-of-school suspension)
- Elementary school
  - Standards-based scores in core subjects and social-emotional learning
  - Enrollment in intervention courses
- Middle school
  - Standards-based scores in core subjects
  - Intervention or replacement course enrollments
  - Missing assignments
  - Tardies

- High school
    - Grades
    - Earned credit hours by grade level/time of the school year
    - Intervention or replacement course enrollments
    - Missing assignments
    - Tardies

Lessons Learned

> "Reports are only as good as the data we have."
>
> – BPSD data expert

As BPSD has increased its use of education indicators, the data team has focused on ensuring that it has accurate data. The more that different teams (such as instructional, administrative, and counseling staff) in the LEA use the report, the more they understand the need for timely and accurate data to be its foundation. LEA leaders have communicated the message to stakeholders that accurate data make people's jobs easier, improve their ability to work with students, and ensure that they receive support when needed.

To help ensure data accuracy, BPSD data leaders suggest the following best practices:

- ✓ To prevent misinterpretation or misuse, have experts and a support system to help schools accurately interpret and use indicators and data.
- ✓ Provide professional development surrounding indicators and their component data, especially where interpretation and administration of assessments are concerned.
- ✓ Meet frequently with building data teams to review and analyze results and train building staff.
- ✓ Ensure that staff review the indicator reports regularly.
- ✓ Focus on multidisciplinary teams—bring academics and behavior together into the same conversation.

Moving Forward

BPSD leaders continue to refine current processes and systems related to the district's indicators. They plan to further enhance the link between academics and behavior, and to consider interventions and support from a whole-child perspective.

Bozeman School District #7 (MT): Using Indicator Data to Set Goals

As one of the largest public school districts in Montana, Bozeman School District #7 (BSD7) has traditionally used education indicators across several areas. In recent decades, LEA leaders have focused on streamlining these indicators and linking them directly to their long-range strategic plan.

Determining Key Objectives via a Culture of Community

Beginning with a community engagement process in fall 2007, BSD7 defined goals and strategic objectives for the LEA. From an initial list of 46 stated objectives, the leadership team used the information from the annual balanced scorecard (which measured success toward objectives) to narrow the list to 21, allowing leaders to assess each objective in greater depth. By 2012, the leadership team decided to measure no more than five of the stated objectives each year, with these objectives chosen by the superintendent and school board. At this point, the list of objectives also had narrowed from 21 to 18. The LEA had previously added a college- and career-ready framework, so the data team developed related metrics in those areas as well.

BSD7 later streamlined its use of indicators into a scaled-down 5-year plan, with four measurable

district goals. Three of these—early literacy, grade-level reading, and social-emotional learning (SEL)—are set, and the fourth is expected to be graduation success. These four goal areas drive the work of students and staff within grade bands and across school sites. Each school site sets actionable goals related to math, English language arts, and SEL. The LEA's MTSS, inclusive of Tiers I, II, and III, is the primary vehicle to address the goals and embedded in the action plans. By addressing those goals at each school, the LEA ensures consistency in efforts to achieve elements of the 5-year plan.

LEA leaders say that BSD7 has benefitted from community engagement as the district works with stakeholders to identify goals for students and schools. Because Bozeman is a growing and changing community, the agency makes sure to reengage stakeholders at least every 5 years. Leaders have learned that although they reach more goals through community engagement, the process takes time. In multiple situations, leaders have found that a slower pace and continued communication are key to success.

Far from a top-down approach, BSD7's decision-making process flows from one level to another, with the efforts of each entity connected via consistent goals. The LEA has a long-range strategic plan, a 5-year district plan, and action plans for each school. Professional development plans and budgeting processes at the school level are tied to these action plans. The work done at each location drives all of the higher level goals. This consistency helps promote buy-in from different stakeholders and sets a vision for the future.

Drilling Down on Achievement

BSD7 also has used indicators to look more specifically into various aspects of achievement across the LEA. For a long time, achievement data reported to stakeholders were broad and general, and public perception was that the LEA was highly successful. Although this was true based on aggregated data, LEA leaders wanted to break down the numbers to illuminate disparities and show which groups of students were struggling. Because the overall data appeared positive, needs for improvement were not being identified.

Although this information traditionally had not been shared publicly, a new leadership team focused on achievement gaps and the policy work needed to hold BSD7 accountable for the success of all students. The LEA was working with these data prior to the coronavirus disease (COVID-19) pandemic, and COVID-19 only accelerated awareness of achievement gaps as BSD7 provided multiple instructional models. BSD7 leaders say that the information they gathered by examining student learning during the COVID-19 pandemic motivated the LEA to make positive changes.

BSD7 has improved in many areas by using indicators to assess gaps. For example, K-5 reading data inspired leaders to move the LEA from using only a balanced literacy curriculum to augmenting teachers' knowledge with 3 years of professional development on the science of reading. BSD7 now is seeing gains in reading performance for all students after many years of static results. The LEA also uses indicators to trace pathways between coursework and graduation rates and to determine when interventions may be most effective in a student's trajectory.

Using Indicator Data to Set New Goals

BSD7 has used its indicator data to make improvements that allow leaders to continue setting goals within the 5-year plan. They aim to have 85 percent of students enter kindergarten with early literacy skills and to supplement prekindergarten programs with other means of promoting language acquisition in communities. Parent engagement data will offer insight into the success of these efforts, which then could inform legislation.

BSD7 also plans to continue emphasizing the science of reading, using teacher knowledge surveys to determine the professional development needs of current teachers. The LEA also will

work with state universities to encourage teaching programs to provide preservice educators with this knowledge.

Moving Forward

BSD7 leaders say that their work is never done, but for good reason. The LEA is committed to a continuous improvement cycle that recognizes and incorporates Bozeman's changing population and potentially shifting needs. Each 5-year plan feeds into the next, which can be hard for some stakeholders who want to succeed and then rest. Because they see the LEA as a student-focused business, BSD7 leaders will not stop until all students can reach a high level of success.

Idaho Digital Learning Alliance: Incorporating Machine Learning to Identify Patterns

The Idaho Digital Learning Alliance (IDLA) was created by the Idaho State Legislature and Idaho educators to provide choice, accessibility, flexibility, quality, and equity in curricular offerings for all students in the state. IDLA provides online courses taught by highly qualified teachers and serves as the state's eLearning expert for virtual education policy and implementation. The organization does not grant course credit or issue diplomas. Instead, it partners with 115 school districts to offer online learning opportunities for all Idaho students.

Introducing Machine Learning

IDLA's key role is to provide supplemental course options for Idaho students. Because the organization makes these online courses available, LEAs do not have to create their own for students who need them. In an ongoing project, IDLA's data experts have worked to create and test machine learning (ML) to identify students who might not be successful in IDLA courses. ML is a type of artificial intelligence (AI) that allows software applications to predict future outcomes by creating an algorithm based on patterns in existing data. When successful, these algorithms become increasingly accurate as patterns are reinforced with new information without being explicitly programmed.

The initial algorithm used information about student activity from the first 2 weeks of class to tease out potential predictors of success or failure. Consistent differences in patterns of activity between students who passed a course versus those who failed could help generate an early warning system. To summarize, if the predictors created by the ML model aligned with the related outcomes from the test data, that model could then be used in the future to identify students who are less likely to be successful in the course.

Working Through the Development Process

As IDLA continued developing the ML model, it brought in computer science students from a local university to assist with the design. While coding the models that then produced patterns, the students needed to collaborate with the education data experts at IDLA. ML models can tease out potentially important information, but the way that ML is implemented is sensitive to the context of the data and how the data are generated and stored. To explain and draw meaning from the identified patterns, education experts need to collaborate with AI experts to examine the patterns. This analysis allows the team to distinguish between data that can yield a predictive pattern and data that are correlated due to mere coincidence.

IDLA mitigated several challenges while developing the model. It found that protecting personally identifiable information (PII) can be more difficult when working with external entities. The team focused on data transport and data privacy, hashing user identifiers so that they could share data, have the data relayed back, and then reidentify the actual students.

Additionally, IDLA needed to change the rational data in its system into data that would be

comprehensible to ML. The data needed to be serialized—or converted into a series of bytes represented by ones and zeroes. Serializing data that do not naturally lend themselves to a binary can be challenging. For example, the team needed to decide how to represent data points such as a grade distribution curve or age of students. Ultimately, some data were too inconsistent or difficult to serialize and had to be eliminated from the model. For example, "zip plus four" codes could not be serialized as zip codes without the additional numbers.

Decoding the "Black Box"

The algorithm used in the initial development was a "black box" predictor; that is, it enabled data experts to assess the model's alignment with real-life outcomes, but it did not indicate which variables went into the model or how each was weighted. IDLA created a predictive black box using 2016 data and found that it was 84 percent accurate in predicting whether 2017 students would fail a course. However, without being able to see what the barriers to success were, teachers could not receive useful information from the model.

To address this issue, IDLA worked with Regional Educational Laboratory (REL)—Northwest to use traditional statistical analysis on the same dataset, hoping to identify the same patterns as the "black box" ML model. At this point, the team had an action plan for the data before they were analyzed. They considered three key aspects of the data:

- outcomes (related to grades and academic results);
- perception (how the student feels about their learning and self); and
- behavior (activity data such as attendance or homework completion).

Although these aspects might be expected to align, IDLA found that they did not. A student might get a good grade without the expected alignment in behavior or perception. The presence of all three data areas therefore makes the data actionable. IDLA leaders suggest moving away from identifying "struggling students" to instead focus on identifying useful interventions. This approach not only more accurately represents the data; it also allows teachers to consider the predictive data within a larger context when working with students.

Lessons Learned

Throughout the ML development process, the IDLA team identified several key lessons. First, agencies must understand the intended use of the results *before* asking for or collecting data, and they must have an action plan. Making decisions about data use after the data have been collected does not work.

Next, the team recommends the following four-step process:

1. Find data patterns.
2. Analyze and predict why those patterns emerged.
3. Test the pattern.
4. Take action.

Throughout this process, the data must be comprehensible to stakeholders who are not data experts. The data team is responsible for translating and clearly communicating the data. Everyone involved needs to understand the range of actions that can or should be taken. The data expert therefore provides key information and makes recommendations about which course to follow.

Finally, IDLA advises data teams to consider both leading and lagging indicators. When looking at the key three data types (outcomes, perception, and behavior), the team noted that outcome data almost always are lagging, but perception and behavior can be leading. As a specific

example, the team found that one of the strongest predictors of outcomes was patterns of activity (behavior). The team looked at how activity related to the course changed over time for students and determined that this type of data was most useful after the first few weeks of class but before the end of the semester. In short, interventions to encourage academic success will be most effective during the central weeks of a term.

Moving Forward

IDLA is still working on its project to identify predictors of course success. After a proof-of-concept stage, the team will launch the solution once the data warehouse is complete. The team expects to continue to incorporate ML into the process and to have many more lessons learned after launching the solution.

Meriden Board of Education (CT): Using Indicator Data to Increase Advanced Placement (AP) Enrollment

Like many LEAs across the country, Connecticut's Meriden Board of Education (MBE) uses the information provided by education indicators for various purposes. One recent project focused on indicators for a newly targeted goal: to increase student enrollment in Advanced Placement (AP) courses.

The organization that administers both the PSAT[3] tests and AP exams provides lists of "AP Potential" students based upon each student's latest PSAT scores. When MBE partnered with an outside education research group on a project to increase AP enrollment, it determined that this single binary indicator is too limiting, as it excludes some students who may be capable of success in particular AP courses.

Beyond the "AP Potential" designation, MBE teachers and administrators recommend students for AP classes based on in-school performance and previous PSAT scores. However, because enrollment for the following school year is based on parent and student online registration in the spring, numbers may remain low if parents or students decide not to register for AP courses.

Working with the research group, MBE searched previous PSAT data for each current student in grades 9 through 11 to help determine their "previous AP potential" (eligibility based on one or more test administrations). They also decided to consider other leading indicators for success in AP courses and focused in particular on growth mindset, a concept popularized originally by psychologist Carol Dweck.[4] In short, students with a more fixed mindset may be more hesitant to take on challenges, whereas those with more of a growth mindset believe that their abilities can be developed. Over time, LEA leaders revised this construct to better fit the MBE school population and created a highly reliable scale to measure it. In addition, reliable subject-level engagement measures, based on Expectancy-Value Theory[5] and the MBE school population, are another indicator of AP success.

In addition to eligibility, prior PSAT scores, and growth mindset, MBE added a fourth indicator as the research moved forward: students' level of engagement in the subject covered by a particular AP course. Based on the data provided by these indicators, the "AP eligible" student pool was larger than the initial pool that relied solely upon each student's latest PSAT scores. Newly identified students received letters signed by the superintendent inviting them to enroll. Ultimately, expanding the criteria for eligibility allowed MBE to increase AP enrollment by more than 30 percent.

3 The PSAT is considered a practice version of the SAT.

4 Dweck, C. (2007). *Mindset: The New Psychology of Success*. New York: Ballantine Books.

5 Wigfield, A., and Eccles, J.S. (January 2000). Expectancy-Value Theory of Achievement Motivation. *Contemporary Educational Psychology*, 25(1): 68-81. https://doi.org/10.1006/ceps.1999.1015

Maintaining Student Success

Beyond simply raising AP enrollment, MBE leaders realized that they also would need to provide additional supports for students new to the more demanding AP coursework. Without these additional supports, students may encounter academic challenges and withdraw from the classes. To prevent withdrawals, MBE recommended supports for new AP students that included required tutors and additional teacher time, study groups for each AP subject, and support for group learning.

Milwaukee Public Schools (WI): Creating Common Indicators to Communicate Accountability Data

Historically, educators in Milwaukee Public Schools (WI) (MPS) have preferred to use education indicators to collect information about district demographics and student learning, including large-scale annual assessments of progress. In recent decades, the LEA has begun to use its indicators more precisely and intentionally. A key part of this process has been improving the agency's ability to communicate relevant information and make informed decisions. To make these improvements, LEA staff have needed to identify areas where connections across agency levels are needed.

Accountability Data: Clarifying Definitions and Creating Common Indicators

Each school in the LEA has an internal improvement plan and annually receives both a state report card and an accountability report under the Every Student Succeeds Act (ESSA). Because the metrics are all unique, the data team needed to create a "through line" in the data to make the metrics more comprehensible to LEA and school leaders, as well as to highlight connections and similarities more clearly. In short, across the LEA, leaders needed to connect the dots among accountability requirements.

The LEA established a through line that included achievement in English language arts (ELA) and math, growth in ELA and math, attendance and absenteeism, and graduation rates. The data team showed that with these connections across the different accountability levels, schools could address central needs for all students—increasing achievement in ELA and math, improving attendance rates, and raising 4-year graduation rates—regardless of the uniqueness of the metrics.

One result of connecting the accountability indicators has been a shift in how several are defined. In some cases, definitions have been aligned across agency levels. For example, the concept of absenteeism was adjusted to provide a single definition across local, state, and federal reporting, which has given the data team a more concentrated focus. In other cases, data users are made aware of the varying definitions, which helps them understand the nuances between reports. For example, across the state, "academic growth" can mean:

- simple growth (LEA level);
- value-added growth (state report card); or
- Mean Student Growth Percentile (SGP) (ESSA reports).

By understanding how the concepts and definitions are related, data users can see that a higher level of simple growth in each student group aligns with a greater positive impact on state and federal indicators.

Challenges and Lessons Learned

MPS faced data challenges due to the COVID-19 pandemic, which led the data team to make adjustments both for the immediate pandemic situation and going forward.

During the pandemic, the LEA continued to stress school improvement even though state and federal accountability data were not fully available. Because the uniqueness of various LEA metrics centers on improved achievement, improved attendance, and improved 4-year graduation rates, these issues still could be addressed at the local level.

Internally, the LEA dealt with missing and incomplete data resulting from pandemic-related data collection issues. In response, the data team created a data history record to monitor submitted data, including how they were (or were not) collected and how different data points were defined. The data team may be able to use this tool for similar data collection challenges in the future.

Moving Forward

Coordinating education indicators within high-quality technology systems across the different agency levels has allowed MPS to increase the speed of data access. Most data points in the LEA (such as attendance, local assessment results, or behavior) are available overnight. Although the timeline is slower for receiving other data from the state, such as state assessment data, secure data systems can release data earlier than in the past.

Data privacy and accuracy also are constant considerations for the LEA. As more systems across the LEA have offered secure access, data leaders have needed to help users understand the critical nature of secure data. Additionally, the LEA has teams with the sole purpose of monitoring data, data quality, and changes in metrics from the state.

Having a multiagency perspective on the system of education indicators allows MPS to make important connections and draw key implications from data about student progress. Ultimately, the LEA's data leaders say that using indicators in this fashion lets them make decisions based on fact rather than tradition or opinion.

North Dakota Department of Public Instruction: Preparing Students for Post-Graduation Success

The North Dakota Department of Public Instruction (NDDPI) began reporting accountability indicators in fall 2017 through a public web portal (https://insights.nd.gov/education) made available through a collaborative partnership with North Dakota Information Technology. Since then, NDDPI has released the state's ESSA accountability reporting annually, with periodic data updates and visualization enhancements that include several publicly available data downloads.

Choice Ready Framework

The North Dakota PK-12 Strategic Vision Framework[6] includes a goal to increase the number of students who graduate "choice ready," which is based on the statewide Choice Ready measure. This framework helps educators ensure that all students leave high school with the essential skills necessary for life after K-12 education. The framework is intended to ensure students are prepared for success in whichever path they choose. To be considered Choice Ready, students must complete the Essential Skills indicator and two of the following three indicators: Postsecondary Ready, Workforce Ready, or Military Ready. NDDPI allows a Choice Ready designation at the time of graduation through a variety of means, including transcript designations, certificates, and other forms of recognition.

Designated school personnel complete the Choice Ready report annually for students enrolled in their respective high schools through a secure, user-authenticated data collection application within the North Dakota Statewide Longitudinal Data System (SLDS) Educator Portal. To ensure data privacy, only personnel with appropriate credentials and approvals can view student data.

6 North Dakota Department of Public Instruction. (2019). *ND PK-12 Education Strategic Vision Framework*. Retrieved April 1, 2022, from https://www.nd.gov/dpi/nd-pk-12-education-strategic-vision-framework.

When possible, data are prepopulated, which minimizes the potential for human error and reduces the time required for school personnel to complete the report. Data contained in the SLDS can be used to automatically fill in 33 of the 54 Choice Ready indicators.

The initial list of Choice Ready indicators included the following:

- Essential Skills
    - 25 hours of community service
    - 2 or more years in organized cocurricular activities
    - 2 or more years in organized extracurricular activities
    - Demonstrated competency in 21st century skills
    - Work-based learning experience
    - Successful completion of a capstone project
    - Successful completion of an online learning course
- Postsecondary Ready
    - Completion of a 4-year rolling plan
    - International Baccalaureate exam (4+)
- Workforce Ready
    - Completion of a 4-year rolling plan
    - Complete Career Ready Practices (3.0) dual credit course (A, B, or C)
    - Technical assessment / Industry credential
- Military Ready
    - Completion of a 4-year rolling plan
    - Armed Services Vocational Aptitude Battery (ASVAB) score of 31 or greater (as determined by branch)
    - Quality citizenship (no expulsions or suspensions and physically fit)

The list of indicators has grown as NDDPI has enhanced options for students to be considered Choice Ready. The Workforce Ready area has been aligned with Perkins[7] accountability indicators that relate to career and technical education programs, including the option for 40 hours of work-based learning. Postsecondary Ready options have been expanded to include successful completion of AP courses. Postsecondary Ready and Workforce Ready have been expanded to include successful completion of college readiness courses for English and math. Additional changes have included test score adjustments and accounting for competency-based learning through the inclusion of numerical grades rather than letter grades.

NDDPI also implemented an "Alternate Choice Ready" designation for students who take the North Dakota Alternate Assessment and have been identified as students with significant cognitive disabilities. This framework contains adjusted criteria including "Life Skills" within the Military Ready category.

Using Choice Ready for Accountability Reporting

Choice Ready, which awards points for accountability using year-over-year growth for North Dakota high schools, was first reported by NDDPI for ESSA accountability in fall 2018. The framework constitutes 21 percent of high school ESSA accountability with points awarded as shown in Table 1.

7 Strengthening Career and Technical Education for the 21st Century Act, P.L. No. 115-224, 132 Stat. 1563 (2018).

School Choice Ready Annual Target	Criteria for School Choice Ready Growth	Points
100% of Choice Ready Growth	10% increment above the previous year percentage or 90-100% of students are Choice Ready	129.00
75% of Choice Ready Growth	7.5% - 9.99% increment above the previous year percentage or 75% of students are Choice Ready	96.75
50% of Choice Ready Growth	5% - 7.49% increment above the previous year percentage or 50% of students are Choice Ready	64.50
25% of Choice Ready Growth	0.01% - 4.99% increment above the previous year percentage or 25% of students are Choice Ready	32.25
No Choice Ready Growth	0% increment above the previous year percentage or less than the previous year percentage or 0-24.99% of students are Choice Ready	0.00

Table 1. Required criteria for North Dakota schools to achieve Choice Ready growth targets.

The Choice Ready indicator is an important component of high school accountability under ESSA to demonstrate whether North Dakota's high schools produce students who are ready for success after graduation. Choice Ready has its own section on publicly available dashboards (https://www.nd.gov/dpi/districtsschools/essa/elements/choice-ready) that present ESSA accountability indicator data. NDDPI has examined results for each reporting year and made summary reports available to stakeholders.

Using Choice Ready Indicators for the North Dakota Scholarship

The 2021 North Dakota legislature approved a state scholarship using indicators from Choice Ready as part of the qualifying criteria, which increased the importance of these indicators for stakeholders. Students and parents now pay closer attention to how schools help ensure that students can meet the Choice Ready requirements. Moving forward, using Choice Ready determination as part of the scholarship criteria will provide further benefit to educators and students in aligning student learning experiences to activities after completing high school.

Ensuring Submission of High-Quality Data

NDDPI has taken several steps to help LEA and school personnel submit high-quality data to the Choice Ready framework. The SEA offers multiple resources, including Choice Ready guidance and instructions on how to submit the required reports. The agency also has hosted training workshops to help ensure that school personnel understand the measure, how to report it, and what it means for students. NDDPI contacts schools near the June 30 submission deadline if they have not submitted the report and offers to help with any complications. Schools' submissions are reviewed to determine whether any data are missing, with follow-up as appropriate. Individualized support and training workshops help ensure complete and accurate reporting for future years. Finally, incorporating educator feedback on Choice Ready into the indicators has enhanced educator buy-in and support for the initiative.

Ohio Department of Education: Coordinating Indicators to Meet Requirements and Provide Robust Information to Stakeholders

In Ohio, state and federal legislation and policy drive the collection and use of education indicators. The Ohio Department of Education (ODE) collects data required for federal reporting, the state accountability system, other state legislation, and stakeholder-driven needs. This data collection is used to identify schools and districts in need of support, or those that have excelled in a variety of ways throughout the school year.

For accountability-related education indicators, ODE publishes prior-school-year data by September 15. Once published, the SEA leverages those results for a variety of state and federal programs, including academic distress, school choice options, priority/focus/watch lists, grant eligibility determination, school funding, and continuous improvement activities.

In 2018, the state implemented an "Overall Grade" for schools and districts. This grade considers six underlying performance metrics based primarily on state assessments and graduation rates. The intent was to provide a high-level indicator that allowed the public to quickly determine how well the district or school was performing in comparison to others. In 2022, the "grade" will transition to a star system rating that will continue to be based on multiple metrics for a simple way for the public to gauge performance.

A Robust and Established Data System

ODE's robust data reporting and warehousing system has been in place since the early 2000s. The SEA has clear reporting requirements and quality assurance processes to collect data consistently. The data team has increased its reliance on visual analytics platforms to display data for users in a variety of new ways. Data visualizations accompanied by intuitive data analytics platforms have allowed ODE to expand its audience and ensure an entry point for data consumption for varied users.

To further strengthen the SEA's processes, the data team works hard to address missing or incomplete data on the front end. The system reviews data submissions in real time and resolves the majority of missing or incomplete data issues at the time of submission. The SEA also has a team of data managers who are responsible for checking data submissions for validity based on prior submissions or data used in accountability calculations. The data quality team reaches out to administrators and walks them through data reporting issues. ODE continually reviews its automatic and manual data checks, as well as its reporting guidance, to ensure that it receives the highest quality data.

Policy Influences

Ohio's education indicators fit within a context of state policy. The state legislature prescribes very detailed requirements for the use of data, calculations, and rating determinations, and the SEA works within these legal requirements. Additionally, legislators may change requirements, which can complicate longitudinal data analysis. The SEA offers caveats for stakeholders when these data are published or presented.

ODE focuses primarily on state-legislated metrics when communicating educational performance to the public. Within the last decade, the state legislature has instituted major changes to education indicators, including changes in graduation requirements and a complete reorganization of the state accountability (report card) system. Additionally, in response to the COVID-19 pandemic, the state legislature introduced flexibility for graduation and third-grade promotion requirements. Such changes sometimes compromise the stability of longitudinal education indicators. Although state-legislated changes to indicators often are improvements, communication, data displays, and analyses around these changes prove challenging.

The SEA also responds to current trends in educational policy and practice and, for some metrics, can alter its calculations. For example, as education leaders have focused more closely on absenteeism over the last several years, ODE and Ohio LEAs partnered to improve the collection of student attendance data. Student attendance is now collected in hours rather than days. The existing chronic absenteeism metric previously was calculated based on students who were educated in a district or school for the majority of the school year. Now, it is calculated to include students who met a minimum attendance hour threshold. Although this revision complicates longitudinal analyses of chronic absenteeism, it has helped LEAs identify and support students who were most at risk for attendance issues.

A Unique Use of Indicators

A unique aspect of Ohio's state accountability system is the Dropout Prevention and Recovery Report Card. Beginning in 2014, Ohio implemented a separate accountability system with distinct metrics for schools that predominantly serve a specific subgroup of students—those aged 16-21 who are at least 1 year behind their peers in academic progress, or those whose academic progress has been interrupted by a crisis. The education indicators for these schools still are based primarily on student assessments and graduation rates. However, evaluations are made based on students' year-over-year progress toward graduation rather than solely on their performance, and rating scales reflect the influential challenges students and schools face in their educational path. Although the SEA is federally required to publish traditional metrics for these schools, the Dropout Prevention and Recovery Report Card is the public-facing evaluation. This separate and unique accountability system provides schools with opportunities to succeed and gain targeted supports for students and staff based on the unique challenges their students face.

Challenges

Data leaders at ODE note that advanced methods of displaying data for stakeholders have come with new challenges. The SEA now publishes more data points than ever before on a variety of platforms, with public demand for more. These additions bring increased potential for privacy issues. For example, ODE historically followed Family Educational Rights and Privacy Act (FERPA) requirements by suppressing data when the denominator of a measure contained fewer than ten students. However, other federal requirements have expanded the student populations for which states must publish data, which has inadvertently heightened the risk to student privacy. ODE is reviewing data privacy policies in combination with published data to strengthen the SEA's privacy policies and publications. Data leaders are considering overhauling the existing data privacy web page to provide the public with more detailed information, including a list of student-related data elements collected and the reason for their collection, as well as an explanation of how student data are used within the agency and in collaboration with stakeholders.

ODE also faces the challenge of users misusing indicators or misinterpreting data that are based on indicators. The SEA has tried to mitigate misuse by supplying clear documentation of business rules in calculations, data caveats, and targeted suggestions. To minimize misinterpretations, ODE has an internal committee of data experts, communication, and legal staff that reviews data requests and determines the best approach to meeting the requestor's goals, including sometimes denying the request. A separate data governance committee of agency leaders reviews any new data leaving the agency to ensure that the data are accurately compiled and are accompanied by the appropriate methodological documentation and communication strategy to help mitigate misuse or misinterpretation.

Lessons Learned

The ODE data team learned that users will interpret data according to their perspectives. To the extent possible, the SEA engages with state legislators and internal and external stakeholders to create indicators that are useful, vetted, and can be tracked over time. They develop extensive documentation and guidance for end users to interpret the data. However, some users or groups still may misrepresent and misuse the data points in ways that do not align with the data presented.

Moving Forward

ODE data leaders acknowledge that the SEA typically has communicated educational success by focusing on one indicator at a time. Moving forward, the department is exploring a holistic approach that leverages longitudinal data to evaluate the impact of education indicators on one another and examines factors that may be driving the results. For example, ODE has engaged in research to evaluate the impact of chronic absenteeism on graduation rates and third-grade promotion, as well as research to understand the impacts of the COVID-19 pandemic on student achievement and attendance. This type of longitudinal analysis is most successful when indicators remain relatively stable and robust over time. ODE expects that reflecting more on indicators' context may help it create new metrics that go beyond typical variables like attendance, assessments, and graduation. Newer metrics, such as those related to social-emotional learning, would highlight various student and teacher experiences that influence common data points viewed as indicators of educational "success."

Pasco County Schools (FL): Increasing Access and Opportunity for Students

Like many LEAs, Pasco County Schools (FL) (PCS) traditionally has used indicators to assess progress, identify areas in need of improvement, and set goals. In recent years, leaders in PCS have expanded their perspectives on—and intentions for—indicators and now are using them to parse out information about equity, access, and opportunity for students in the district.

Using Indicators to Share Information and Identify Goals

PCS's instructional team holds regular calibration meetings during which team members evaluate data to assess progress and identify opportunities. They also consider how the goals they set will impact the work of various stakeholders in the district. The team also conducts site visits and needs assessments to plan for the following school year, with a focus on providing consistent messages to schools. When sharing information with schools, the team tries to help stakeholders make connections between the work they do and the initiatives put forth by the LEA as a result of data trends.

The team realized, however, that some areas that had been identified called for more intentional focus and action. Specifically, the team found disproportionality among student groups across areas such as behavior, discipline, and enrollment in advanced courses, but it still needed more comprehensive information related to equity, access, and opportunity to determine which actions to take.

Equity Audit

PCS had been working with an outside consulting company before identifying the need for additional information on equity, access, and opportunity. The consultants created an "opportunity scorecard" looking at measures such as the content of assignments, level of rigor, and teacher expectations. The assessment also addressed issues such as access to educational opportunities and trends in discipline. The consultants helped train and walk the LEA through the information, as well as facilitating dialogue about school strengths and potential areas for improvement.

As this work continued, PCS realized it needed additional equity metrics. The LEA worked with the consultants to conduct an equity audit, which became its own project in 2021. The equity team needed a baseline of the LEA's current status to see where changes might be needed. The audit used indicators drawn from data that the LEA already had, but the team examined and aligned the information in new ways.

The audit assessed data from the previous 6 years through May 2021, focusing on:

- student achievement (specifically, whether students are learning at similar rates);
- courses (number of students in advanced classes);
- grades (whether grades provide a true measure of competence when weighed against end of year tests);
- attendance and discipline rates (whether trends are similar across students); and
- teacher background (how demographics of teachers relate to those of students).

Specific assessments included concepts such as grade alignment and grade guarantee. Grade alignment asked whether earning better grades equaled a student having learned more, and correlated grades with scores on end of year tests required by the LEA. Grade guarantee asked whether the grade a student earned aligned with having learned more of the class's specific content. Each of these concepts also was tied to classroom context indicators.

The audit allowed PCS's equity team to triangulate the data provided by the different indicators. The team could demonstrate that the various elements were showing the same trends for student groups in terms of access and opportunity. The deep dive into the indicators meant that the team went beyond simply identifying potential disproportionality to also zero in on key goals for improvement. Team leaders expect that the information provided by the audit will influence the development of new indicators. PCS now will be able to put relevant metrics into its yearly Success Plan in a more intentional way.

Lessons Learned

The equity team presented the full audit results to the school board. The audit included many new considerations and recommendations, which made it challenging for the board to easily process the findings at one time. The findings were therefore separated into several parts and later presented to the calibration group in multiple meetings across several months.

Information from the audit underscored the importance of PCS's data and indicators. Over time, PCS had seen similar findings across variables but did not immediately look for the meaning behind these consistent trends. Conducting the audit helped PCS understand where it stands concerning its goals, allowed for more intentional efforts toward progress, and ensured continued focus on these areas.

Moving Forward

With the information from the audit now available to guide goal-setting and drive the creation of new indicators, PCS knows how important it will be to stay focused on the information that emerged from the data. The identifiers used in the audit showed important trends related to equity, access, and opportunity that have influenced PCS's goals for the future and potential interventions. However, it will be crucial to continue to monitor the data and adjust interventions in response to changing trends or student outcomes.

Virginia Department of Education: Providing a Holistic View of Student Achievement

In response to various accountability requirements, the Virginia Department of Education (VDOE) has worked to create and implement education indicators that accurately represent students' achievement and coursetaking pathways. Incorporating both end-of-course tests and a cohort model, VDOE's indicators provide a holistic view of achievement in different areas.

Using a Cohort Model for Mathematics Accountability Indicators

Under the requirements of ESSA, states must report student scores on annual assessments in English language arts and mathematics. Prior to ESSA, VDOE used a variety of mathematics tests for accountability purposes at the high school level to reflect the various levels students had reached. Because ESSA required the SEA to report on a single end-of-course test, leaders chose Algebra I because a majority of students complete this course during their high school years.

VDOE faced a dilemma, however. Many Virginia students take Algebra I—and sometimes Geometry and Algebra II—during middle school, so these end-of-course tests could not be part of the accountability equation for those students in high school. SEA leaders needed a way to acknowledge accelerated coursetaking patterns and accurately demonstrate mathematics achievement, so they developed a cohort reporting model that better reflects the nature of math education across the state. For students who took one or more of these courses before high school, accountability data would be based upon the end-of-course exam for whichever course the student took first in high school. For those accelerated students who took all three courses before high school, scores from other college- and career-ready exams (such as AP tests, SATs, or International Baccalaureate [IB] exams) could be used. The uniqueness of this indicator's design reflects VDOE's integration of end-of-course exams and use of a cohort model. SEA leaders note that this type of flexibility in indicator design provides richer and more useful information for agencies that may have complicated contexts.

Ultimately, Virginia decided on a calculation for mathematics achievement that is both cohort-based (the denominator is the same as the denominator of the graduation rate) and longitudinal (the numerator considers all the tests taken in the past 5 to 7 years to determine which test to include in the accountability formula). They report that the cohort model allows them to balance accountability with a clearer, more holistic view of mathematics achievement that is consistent with the cohort-based graduation rate. It provides a more comprehensive picture of achievement and informs the agency's academic support for LEAs and schools. For example, stakeholders cannot claim that indicator data are just a "blip" or single weak year. Additionally, the model's flexibility does not discourage student acceleration through required courses. Instead, it allows students to move forward without their schools' accountability data being negatively affected. Ultimately, VDOE leaders say, the system is designed to teach students what they need when they need it.

Other Indicators

In addition to developing this cohort-based mathematics achievement indicator for federal reporting, VDOE has worked to provide a more holistic view of other key areas through its second, state-focused accountability system. Based on past experience with graduation indicators and current experience with the mathematics pass rate, SEA leaders also have designed a College, Career, and Civic Readiness Indicator (CCCRI) and a dropout rate indicator that are both cohort-based and use longitudinal data. The CCCRI assesses the number of students completing AP and IB courses, dual enrollment, service learning, work-based learning, or a sequence of two career and technical education (CTE) courses and a credentialing exam.

These data are collected through multiple collections, but the model is designed to provide an unduplicated student count. For example, if a student takes both AP and IB courses, the student is counted only once.

VDOE leaders' experience with cohort rates has begun to influence the agency's development of early childhood indicators, as well. Although this process is still in its early stages, VDOE's longitudinal data system is mature. The SEA is building cohorts of students at the early childhood level and planning to see how these cohorts later perform on third-grade tests. SEA leaders intend to measure these students regularly to see if these early experiences have an impact later on.

Managing Challenges

As VDOE continues to develop and use its indicators, agency leaders have taken several steps to handle potential challenges. For example, the SEA focuses on training to explain how these indicators were developed and why these particular education indicators are better as cohort-based calculations than as traditional annual calculations. Effective messaging during the transition to the new indicators was critical as some stakeholders were not familiar with cohort calculations. Additionally, because Virginia has both a federal accountability system and a state accreditation system, new staff must be trained on the complexities of the systems and the differences between the two.

To help the divisions understand the calculations, VDOE created roster reports that include a list of all students in the cohort along with some student demographics and the student's status on achieving the indicator. In the case of the mathematics achievement indicator, the roster report contains each student's grade when they took the Algebra I, Geometry, and Algebra II end-of-course tests, along with a pass-fail indicator on the test that the student took in high school. Having the SEA provide the roster reports of historical data eases the burden of tracking longitudinal data of students–especially those students who transfer into the school after the ninth grade.

Finally, VDOE focuses on cross-process collaboration, with all offices represented in training sessions and weekly workgroups. SEA leaders emphasize that developing and using indicators is an iterative process, with needs and implications changing regularly.

Moving Forward

While developing and using VDOE's education indicators, SEA leaders have learned much about the "ripple effect" as various data points, processes, and situations influence one another. Although the SEA has gained a lot by using cohort models, there can be drawbacks. The cancellation of all state assessments in spring 2020 due to the COVID-19 pandemic meant that test data were not recorded, which will affect the model for several years beyond the single year that assessments were canceled. Data leaders need to consider these concerns for each indicator. Although affected students can be removed from the calculation in this situation so it is not adversely impacted by a test that did not occur, other situations may be more complicated. For example, VDOE has had to consider how to account for students who should have taken a particular exam but were not able to, whether due to the COVID-19 pandemic or other factors.

VDOE leaders say that the agency has done a lot of useful work with education indicators, but some wish they had known exactly what the process entailed in order to establish clearer rules at the beginning. They acknowledge that many of the SEA's rules were developed as problems surfaced. Now that their different accountability and achievement indicators are both well developed and flexible, however, the agency has a solid but responsive foundation from which to move forward.

Appendix A:
Examples of Local and State Education Agency (LEA and SEA) Indicator Categories

The examples in this appendix were provided by Forum Education Indicators Working Group members to illustrate different types of indicator categories at the LEA and SEA levels.

Bismarck Public School District (ND)

- Academic
  - Grades
  - Grade Point Average (GPA)
  - Standards Scores
  - Competency or Mastery
  - Assessment Scores
  - Graduation Rate
  - Participation in Early College Coursework
  - Students Who Require College Developmental Courses
- Behavioral
  - Attendance
  - Discipline Events
  - Discipline Dispositions (suspension, expulsion, detention, or other)
  - Behavioral Standards Scores (respect; responsibility; Collaborative for Academic, Social, and Emotional Learning [CASEL] aligned standards)
  - Missing or Late Assignments/Work
  - Assessment/Survey Participation Rates
  - Student Engagement
- Environmental
  - Student-Teacher Ratio
  - Average Classroom Size
  - Student-Device Ratio
  - Learning Mode (in-person, hybrid, remote, or blended)
  - Extracurricular/Cocurricular Opportunities
  - Career/Tech Opportunities
  - Teacher Years of Experience
  - Teacher Education Levels
  - Demographic Breakdowns
  - Spending per Pupil

    - Dual Credit/Advanced Placement (AP) Course Offerings
    - Professional Development Opportunities/Participation
    - Staff Retention Rate
- Complex/Compound Indicators
    - Indicators with multiple components spanning one or more category. Dropout rate could be an example as it can be affected by both behavioral and academic factors.

Boise School District (ID)

- National Assessments
    - ACT
    - PSAT
    - SAT
- State Standardized Tests
    - Idaho Reading Indicator Scores
    - Idaho Standards Achievement Test Scores
    - WIDA
- Local Assessments
    - Istation Reading Scores
    - End of Course Assessments
    - Star Reading Scores
    - Imagine Math
    - i-Ready
- State Indicators
    - Go On Rate (Attending College)
    - Multi-Language Learner
    - At-Risk Status
    - Graduation Rate
- Federal Indicators
    - Free and Reduced Lunch Status
    - Title I Status
- Local Indicators
    - Grades
    - Attendance
    - AP Status
    - AP Scores
    - Dual Credit Status
    - Credits Earned
    - On Track to Graduate Status
    - Home Language
    - Schools Title I Status
    - Grade Level
    - Age
    - Special Education Status
    - Limited English Proficiency (LEP) Status
    - Open Enrollment Status
    - Number of Schools Attended

- Homeless Status
- Behaviors
- Enrollment Status

Guam Department of Education

- Condition of Education
  - Education Finance and Resources Indicators (investment in education)
  - Human Resources in Education (teacher quality and supply, auxiliary personnel quality and supply, school leader quality and supply, etc.)
  - Capital Investment in Education (expenditure on teachers, expenditure on facilities, expenditure on classroom resources, etc.)
- Education Process Indicators
  - Participation, Engagement, and Attendance Indicators
  - Access to Education Indicators
  - Equity Indicators (gender balance/imbalance, socioeconomic status balance/imbalance affecting education outcome)
- Education Outcomes Indicators
  - Education Attainment (refers to percentage of population completing high school, college degrees, etc., rate of increase/decrease of talent pool, variations of education attainment across states)
  - Education Assessment (refers to percentage of students attaining defined performance levels)
  - Education Achievement (graduation rates, completion rates, rate of transition K-12 to postsecondary)
  - Education and Economic/Social Outcomes (indicators depicting health and wellness, indicators depicting the social benefits of education, life satisfaction as a benefit of education, etc.)

Jefferson County Public Schools (KY)

- Academic Performance
  - Assessments
    - District Benchmark Assessments (Measures of Academic Progress [MAP])
    - State Accountability Assessments
    - National Assessments (National Assessment of Educational Progress [NAEP], Trial Urban District Assessment [TUDA], ACT, SAT)
  - Educational Opportunity
    - Participation in Advanced Coursework
    - Gifted and Talented
    - Career Pathway Participation
    - Number of Artifacts of Success Skills (district specific)
    - Number of Student Defenses (district specific)
  - Transition Readiness
    - Promotion/Retention Rates (rates of students who are behind in credits)
    - Graduation Rates
    - Transition Readiness Rate (rate of students meeting college/career benchmarks)
    - Dropout Rates

- Nonacademic/Climate
    - Student Attendance Rates
    - Chronic Absenteeism
    - Number of Suspensions (in and out of school)
    - Number of Behavior Referrals
    - Student Sense of Belonging (climate survey perception data)

Note: All of these data can be disaggregated by student group.

Milwaukee Public Schools (WI)

- Principal's Landing Page
    - Budget
    - Overview (Attendance, Behavior Achievement)
    - Performance Summary Report
    - Staff Attendance
- Academics
    - AP
    - College/Career
    - Course Performance
    - Courses
    - Grades
    - Subject Analysis
- Assessments
    - All Local and State Assessments
- Attendance
    - Cohort
    - Overview
    - Cross Tab
    - Historical Data
- Behavior
    - Disproportionality
    - Referrals
    - Classroom Overview
    - Discipline
    - Historical Data
- Enrollment
    - Demographics
    - Dropouts
    - English Learner (EL) Status
    - Historical Data
    - New Enrollments
- Interventions
    - Progress Monitoring
    - Behavior
    - Academic
    - Attendance

- Mobility/Stability
    - District
    - School
    - Historical Data
- Early Warning
    - Grades
    - Achievement
    - Graduation
    - Behavior
    - Failures
- Examples from the LEA's public site
    - Overview
    - Digital Equity
    - Every Student Succeeds Act (ESSA)
        - Overview
        - Student Performance Data
        - Finance Resources
        - Post-Graduation Data
    - Student Engagement
        - Attendance-Dropouts
        - Discipline
        - Enrollment
        - Enrollment-Private School
    - State Tests
        - Overview
        - ACT Aspire
        - ACT Statewide
        - Badger
        - Forward
        - Choice School Results (DPI-Web)
    - Coursework
    - Graduation

Ohio Department of Education

- Discipline
- Enrollment
- Financial
- Graduation
- Student Attendance
- College and Career Readiness
- Early Literacy
- Teacher and Staff
- Scholarship
- Nonpublic
- Achievement
- Progress

- Gap Closing
- Special Education
- Gifted

Pasco County Schools (FL)

- Perceptual
- Academic (course, tests, etc.)
- Attendance
- Behavior
- Engagement (attendance, behavior)
- Employee

Virginia Department of Education

- Categories based on time
    - Annual (one school year)
    - Administrative Session (semester, school year, testing window)
    - Grade Level
    - Cohort
- Categories based on data availability
    - Current (most recent administrative session)
    - Most Recent (last known data point no matter when it happened)
    - Annual (one school year)
    - Longitudinal (whole history)
- Categories based on focus
    - Academic (progress, proficiency, growth, attainment, promotion/retention)
    - Graduation (including college and civic preparedness)
    - Behavioral (including administrative responses to student behavior)
    - Enrollment (membership, attendance rates, chronic absenteeism)
    - Social Well-being (including lunch program participation, work-based learning opportunities, career and technical education [CTE] courses offered, after school learning opportunities)
    - Instructional (teacher effectiveness, vacancy rates)
    - Administrative (transportation efficiencies, central office licensure, etc.)

Reference List

Dweck, C. (2007). *Mindset: The New Psychology of Success*. New York: Ballantine Books.

National Forum on Education Statistics. (2021). *Forum Guide to Metadata* (NFES 2021110). U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved January 27, 2022, from https://nces.ed.gov/forum/pub_2021110.asp.

North Dakota Department of Public Instruction. (2019). *ND PK-12 Education Strategic Vision Framework*. Retrieved April 1, 2022, from https://www.nd.gov/dpi/nd-pk-12-education-strategic-vision-framework.

Statewide Longitudinal Data Systems Grant Program. (2020). *History of the SLDS Grant Program: Expanding States' Capacity for Data-Driven Decisionmaking*. U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved September 22, 2022, from https://slds.ed.gov/#communities/pdc/documents/16862.

Strengthening Career and Technical Education for the 21st Century Act, P.L. No. 115-224, 132 Stat. 1563 (2018).

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. (January 2022). *About the National Assessment of Educational Progress (NAEP)*. Retrieved January 26, 2022, from https://nces.ed.gov/nationsreportcard/about/.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. (n.d.). *Program for International Student Assessment (PISA)*. Retrieved January 26, 2022, from https://nces.ed.gov/surveys/pisa/.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. (n.d.). *Progress in International Reading Literacy Study (PIRLS)*. Retrieved April 4, 2022, from https://nces.ed.gov/surveys/pirls/.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. (n.d.). *Trends in International Mathematics and Science Study (TIMSS)*. Retrieved January 26, 2022, from https://nces.ed.gov/timss/.

Wigfield, A., and Eccles, J.S. (January 2000). Expectancy-Value Theory of Achievement Motivation. *Contemporary Educational Psychology,* 25(1): 68-81. https://doi.org/10.1006/ceps.1999.1015.

Related Resources

Additional Resources

Choice Ready

https://www.nd.gov/dpi/districtsschools/essa/elements/choice-ready

Choice Ready is a new component in the North Dakota accountability system to measure whether the state's high schools are producing students who are ready for success upon graduation. The metrics outlined within the Choice Ready initiative are intended to measure growth for North Dakota high schools, as indicated by student readiness upon high school graduation.

Condition of Education

https://nces.ed.gov/programs/coe/

This report contains key indicators on all levels of education, labor force outcomes, and international comparisons. The indicators summarize important developments and trends using the latest statistics, which are updated throughout the year as new data become available. Spotlight indicators provide more in-depth analyses on selected topics.

Digest of Education Statistics

https://nces.ed.gov/programs/digest/

This resource contains a set of tables covering the broad field of American education from prekindergarten through graduate school.

A Framework for Data Quality

https://nces.ed.gov/fcsm/pdf/FCSM.20.04_A_Framework_for_Data_Quality.pdf

This Federal Committee on Statistical Methodology report presents a framework for identifying data quality for all data, summarizes the current state of practice in identifying threats to data quality for the components of the framework, and provides guidance for promoting effective reporting of data quality.

National Forum on Education Statistics Resources

Forum Data Visualization Online Course (2019-2022)

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

This online course is designed to help education agencies communicate data meaning in visual formats that are accessible, accurate, and actionable for a wide range of education stakeholders. It is based on the *Forum Guide to Data Visualization: A Resource for Education Agencies* (https://nces.ed.gov/forum/pub_2017016.asp). This course is intended for staff in local, state, and federal education agencies whose responsibilities include any aspect of analyzing data or sharing meaning through data with education stakeholders.

Forum Guide to Metadata (2021)

https://nces.ed.gov/forum/pub_2021110.asp

This resource presents and examines how metadata can be used by education agencies to improve data quality and promote a better understanding of education data. The resource highlights the uses of metadata, discusses how to plan and successfully implement a metadata system in an education setting, and provides examples of standard metadata items and definitions to assist agencies with standardization.

***Forum Guide to Cybersecurity: Safeguarding Your Data* (2020)**

https://nces.ed.gov/forum/pub_2020137.asp

This resource provides timely and useful best practice information to help education agencies proactively prepare for, appropriately mitigate, and responsibly recover from a cybersecurity incident. It provides recommendations to help protect agency systems and data before, during, and after a cybersecurity incident and features case studies from local and state education agencies (LEAs and SEAs).

***Forum Guide to Technology Management in Education* (2019)**

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

This resource is designed to assist education agency staff with understanding and applying best practices for selecting and implementing technology to support teaching and learning in the classroom. It addresses the widespread use and integration of technology in modern education systems and focuses on technology governance and planning, technology implementation, integration, maintenance, support, training, privacy, security, and evaluation.

***Forum Guide to Planning for, Collecting, and Managing Data About Students Displaced by a Crisis* (2019)**

https://nces.ed.gov/forum/pub_2019163.asp

This resource provides timely and useful best practice information for collecting and managing data about students who have enrolled in another district or school because of a crisis. It highlights best practices that education agencies can adopt before, during, and after a crisis and features contributions from agencies that have either experienced a crisis or received students who were displaced by a crisis.

***Forum Guide to Early Warning Systems* (2018)**

https://nces.ed.gov/forum/pub_2019035.asp

This resource provides information and best practices that will help education agencies plan, develop, implement, and use an early warning system in their agency to inform interventions that improve student outcomes. This document focuses on early warning systems and their data from the perspective of the education data community.

***Forum Guide to Collecting and Using Disaggregated Data on Racial/Ethnic Subgroups* (2016)**

https://nces.ed.gov/forum/pub_2017017.asp

This resource is intended to identify some of the overarching benefits and challenges involved in data disaggregation, recommend appropriate practices for disaggregating racial/ethnic data in districts and states, and describe real-world examples of large and small education agencies disaggregating racial/ethnic data successfully.

***Forum Guide to Education Data Privacy* (2016)**

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

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

***Forum Guide to Taking Action with Education Data* (2013)**

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

This resource 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, LEAs, and SEAs.

***Forum Guide to Data Ethics Online Course* (2010)**

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

This online course is based on the *Forum Guide to Data Ethics* and is focused on how ethical principles apply to education data. It is intended for any person who handles data in an education organization, including superintendents, chief information officers, principals, teachers, registrars, counselors, school board members, data managers, technology directors, information systems staff, data stewards, technical staff, office staff, paraprofessionals, volunteers, and vendors.

***Forum Guide to Data Ethics* (2010)**

http://nces.ed.gov/forum/pub_2010801.asp

While laws set the legal parameters that govern data use, ethics establish fundamental principles of "right and wrong" that are critical to the appropriate management and use of education data in the technology age. This guide reflects the experience and judgment of seasoned data managers; while there is no mandate to follow these principles, it is hoped that the contents will prove a useful reference to others in their work.

***Forum Curriculum for Improving Education Data: A Resource for Local Education Agencies* (2007)**

https://nces.ed.gov/forum/pub_2007808.asp

This curriculum supports efforts to improve the quality of education data by serving as training materials for K-12 district and school staff. It provides lesson plans, instructional handouts, and related resources, and presents concepts necessary to help schools develop a culture for improving data quality.

***Forum Guide to Education Indicators* (2005)**

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

This resource is intended to help the education community better understand how to appropriately develop, apply, and interpret commonly used education indicators. The resource defines the concept of an education indicator, describes the process of establishing a body of education performance and context indicators, and describes 44 education indicators that were commonly used to measure the status of, or change in, education institutions across the nation.

***Forum Guide to Building a Culture of Quality Data: A School & District Resource* (2004)**

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

This resource was developed to help schools and districts 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. This resource shows how quality data can be achieved in a district or school through the collaborative efforts of all staff.