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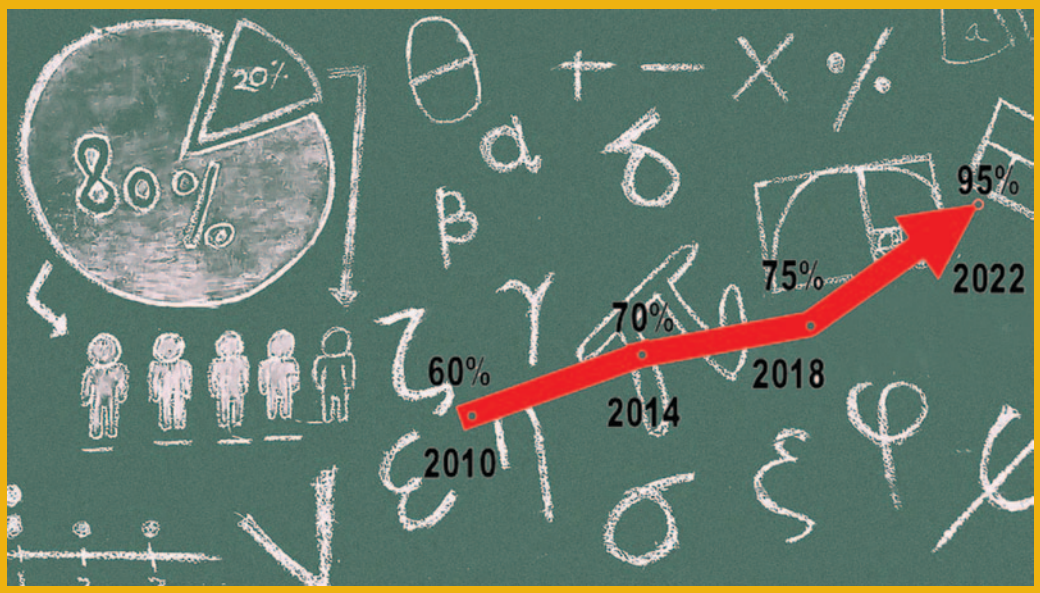

From Compliance to Learning

A SYSTEM FOR HARNESSING THE POWER OF DATA IN THE STATE OF MARYLAND

Husein Abdul-Hamid,
Sarah Mintz, and Namrata Saraogi

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ISBN (paper): 978-1-4648-1058-9
ISBN (electronic): 978-1-4648-1059-6
DOI: 10.1596/978-1-4648-1058-9

Cover photo: © Pixabay, www.pixabay.com.
Cover design: Debra Naylor, Naylor Design, Inc.

Library of Congress Cataloging-in-Publication data has been requested.

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Acknowledgments

This report was prepared by SABER-EMIS team members Husein Abdul-Hamid (Task Team Leader), Sarah Mintz, and Namrata Saraogi. Special thanks to colleagues providing support and feedback: Dingyong Hou and Noah Yarrow (peer reviewers), Manar El-Iriqsousi, Cassia Miranda, Jian Guo Zhu, Michael Melamed, and Wouter Takkenberg. The report benefited immensely from the guidance and support of the Maryland State Department of Education, including Dr. Jack Smith, Chief Academic Officer, Office of Teaching and Learning. Finally, the SABER-EMIS team is especially grateful for the insights provided by principals, teachers, and administrators in Anne Arundel County, Cecil County, Charles County, Harford County, Howard County, Kent County, and Montgomery County.

Executive Summary

In the digital age, information is power. When information is effectively harnessed and aligned with student learning, it carries the potential to radically transform the delivery of education, as well as the sector as a whole. Increasingly, education systems are moving away from using education data narrowly for compliance purposes; instead, they are embracing data as a tool to drive system-wide innovation, professionalization, and, most importantly, learning. Whether to prioritize and optimize data and information systems around student learning is no longer an option; it is an imperative for education systems that aim to excel and achieve strong learning outcomes.

Over the past several decades, fundamental shifts have occurred in the way that education data are collected, managed, and used. Today real-time learning data inform classroom instruction; predictive analytics identify at-risk youth before they drop out of school; and data from preschool to workforce (also referred to as P-20W) are linked to help guide education reforms. These represent just a few of the innovative ways that schools and other stakeholders across the United States are harnessing data to improve education.

This report builds on a 2015 World Bank report that assessed education management information systems (EMIS) in the state of Maryland. That report uncovered a successful system, and this one expands on lessons learned and ways to apply them in practice. The goal of this report is to distill Maryland's good practices in education data systems and share them in a way that is useful to education stakeholders interested in harnessing the power of data to strengthen learning outcomes. This report also examines the history of education data collection and use in the United States with a focus on Maryland, including a review of federal and state legislation that has helped to shape the state's education data policies and systems.

At its core, the concept of moving from compliance to learning hinges on the way in which information is used in an education system. An education system that uses information for compliance purposes generally focuses on a narrow set of tests and resulting sanctions for those students, teachers, schools, districts, and states that fail to meet target scores. As Darling-Hammond and Weingarten (2014) explain, the theory is that mandated testing schedules and legislated improvement rate targets—coupled with the threat of tough sanctions—will lead to improvements in educators' efforts and, consequently, student performance.

A compliance approach relies heavily on the negative incentive, the punishment, or the "stick."

In contrast, a learning approach uses information to support and improve a shared accountability model in which all stakeholders—policy makers, principals, teachers, school administrators, parents, and students—are responsible for student learning (Linn 2003). With this approach, Darling-Hammond and Weingarten (2014) argue, students get the most out of the system. Specifically, benefits include (1) curriculum, teaching, and assessments that are focused on meaningful learning; (2) adequate resources that are spent wisely; and (3) professional capacity building that provides opportunities for teachers and school leaders to develop the knowledge and skills they need to teach challenging content in more effective ways. Under the learning approach, stakeholders across the education system are able to tap information to strengthen education system processes and practices and, ultimately, to improve learning outcomes.

A Brief History of Education Data in the United States

The United States first began conducting education statistics surveys in 1870, under what would later become the National Center for Education Statistics (NCES). Initial surveys tracked basic information, such as public elementary and secondary school enrollment, attendance, numbers of teachers and their salaries, high school graduates, and expenditures (U.S. Department of Education 1993).[1]

According to the U.S. Department of Education (1993), capturing education data during those early years was a formidable task. The size of the country, combined with a decentralized education system and limited staff, created considerable hurdles. Statistical techniques used at the time had a limited ability to compensate for nonresponse rates, in part because of a lack of baseline data from which to derive reasonable estimates. Adding to these challenges, states and territories did not consistently provide accurate data. In the early years, the NCES depended on the decennial census to fill data gaps.

Over the next 50 years, survey coverage expanded to include data on private elementary and secondary school enrollment, teachers, and graduates, as well as enrollment by subject field in public high schools, public school revenue receipts by source, and a detailed breakdown of public school expenditures by purpose. In 1923, the Center's statistical program hired four "Principal Statistical Assistants," who were tasked with making field visits every two years to work with state departments of education that had not responded fully to requests for statistical information. The field staff filled a major gap in data collection, enabling the Center to report national totals that were virtually 100 percent complete (U.S. Department of Education 1993). Between the 1920s and 1960s, the number of Center staff grew significantly, leading to expanded and more timely statistical analysis and reporting.

A major shift in data reporting and utilization occurred during the preparation and passage of the Elementary and Secondary Education Act (ESEA) of 1965.

During this time, policy makers used the Center's education statistics to support education legislation making its way through the U.S. Congress. According to the U.S. Department of Education (1993, 2), "It is no exaggeration to say that the Center's statistics played an indispensable role in the passage of a number of acts of Congress which provided support to elementary, secondary, and higher education."

Although increasingly useful, the Center's reports focused on inputs rather than outcomes. To fill this gap and better assess the quality of education, the Center launched the National Assessment of Educational Progress (NAEP) in 1969. This assessment marked one of the early steps away from using data to track inputs and toward using data to understand and inform learning outcomes. The NAEP is covered in more detail in later sections of this report.

Nearly 150 years after the NCES was launched, the U.S. education system is awash in data. Since the 1990s, education systems at local, state, and federal levels have invested considerable time and resources to establish and upgrade the systems necessary to harness the plethora of data. While construction of the technical architecture itself poses a hurdle, additional challenges exist around building the policies, processes, and culture that are necessary to make full use of these data. This report examines the state of Maryland and its journey toward using education data for learning.

Among the 50 U.S. states, Maryland has consistently taken the lead in passing policies that push the limits of how education data are used, harnessing data in innovative ways to improve accountability and learning outcomes. In the early 1970s, Maryland implemented an educational accountability law that mandated statewide goal setting and testing, and it was among the first pieces of legislation in the country to mandate school-level report cards. These report cards may be common today, but at the time, they were seen as innovative, even revolutionary (Michaels and Ferrara 1999). Between 1976 and 1982, Maryland adopted and implemented Project Basic to fill gaps in the Maryland Accountability Testing Program report, such as a lack of attendance information and disaggregated performance data. The driving concept behind Project Basic was that school is an incubator for skills that lead to an effective and fulfilling adulthood. Hornbeck (1977) notes that Project Basic prepared students by arming them with a fundamental ability to cope with themselves and others in a variety of settings, from family, to community and nation, to workplace. In the early 1990s, Maryland began administering the Maryland School Performance Assessment Program (MSPAP), applying the findings to evaluate schools and guide school improvement efforts. More recently, the Maryland General Assembly passed the Education Reform Act, and the State Board of Education adopted the Common Core State Standards, a more rigorous and thinking-based set of content standards.

These and other policies and programs illustrate Maryland's focus on using data to drive school improvement and learning outcomes. This report examines both Maryland state laws and influential federal policies and their role in helping the state shift the focus from compliance to learning.

Summary of Findings

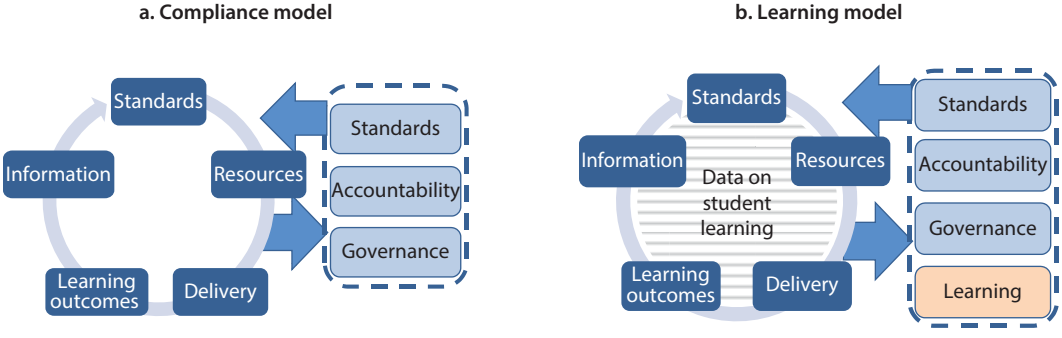
Not only is the state of Maryland's public school system among the highest-performing nationwide, but Maryland is also at the forefront of a national trend to use data in innovative, learning-centric practices. At both state and county levels, a variety of good practices and key insights can help to inform education stakeholders around the world who are rethinking their education data systems. Some of the most salient points are summarized below, and they are discussed in greater detail throughout this report.

Support from the highest levels of leadership is essential, but buy-in must continue down the organizational structure and throughout the education system. State leaders received the support of directors and managers, who implemented their vision on the ground. Without this buy-in at multiple points across the education system—including county administrators, principals, and teachers—advancements in data-collection management and utilization are challenging, if not impossible.

The journey from a compliance-focused data system to a learning-focused one, while complicated, is also a game changer. At the core of this transition is a behavior change in the way that data are valued. Specifically, it involves a shift from seeing data as a static monitoring tool, to understanding that data and the larger information system can be used in dynamic ways to promote teaching and learning, as well as management and planning. Data on the quality of student learning, for example, play an essential role in strategic management, planning, and learning (figure ES.1). This report documents important factors that helped Maryland to make this transition.

A sustainable and well-functioning data system requires acknowledgment that the system is more than just an information technology (IT) system for storing and reporting data. At both state and county levels in Maryland, the design and operation of each data system generally was driven by policies, people, and processes, in addition to the underlying IT architecture. A common problem for others setting up data systems, in contrast, has been a tendency to view the system as simply an IT tool. For a data system to be successful requires a holistic

Figure ES.1 Moving from Compliance to Learning



approach that takes into account the many factors that contribute to its long-term effectiveness and sustainability. Besides technology, these include people, processes, policies, and a robust data culture.

The highest levels of leadership should possess and articulate a vision for the data system and data utilization. In Maryland, then Governor O'Malley demonstrated support for the Maryland Longitudinal Data System. Dr. Jack Smith, Chief Academic Officer, Office of Teaching and Learning at the Maryland State Department of Education, advocated tirelessly for using data in planning, management, and decision making, as well as for ensuring that frontline educators had the skills to use data to inform their classroom teaching. Renee Foose, Superintendent of Howard County Public Schools, meanwhile, drove the implementation of an integrated data system in her school district. Effective leaders catalyze change and adoption, bring different stakeholder groups together, define the road map, ensure effective funding and staffing, and lead by example.

To establish an effective data system, successful policy makers focus on translating policies into a culture of data utilization. This report contains a variety of good practices with regard to institutionalizing data use and data systems by bridging policy intent and implementation. It is important that policy makers not only develop legislation and strategic plans but also think through to implementation. This process includes supporting and advocating for tools, resources, incentives, institutionalization practices, and communication efforts that can help transform high-level policy intent into on-the-ground implementation.

Commitment to ongoing professional development and capacity building yields significant returns. There is never an end to professional development, and this is true for education stakeholders who collect, manage, and use education data. Ensuring an adequate budget for professional development, as well as for strategies that scale professional development, strengthens data quality and utilization. For example, Maryland's Harford County effectively scaled professional development for those who worked with the county's education data system through a train-the-trainer model. Further, it is important to think about capacity building for stakeholders at all levels, from teachers to policy makers, and not just for the core team responsible for maintaining the data system.

Data utilization at the school level is crucial. As the front line of data collection, schools are essential to the overall success of a data system. Policy makers can strengthen the overarching system by ensuring that teachers and principals are not simply inputters of data but thoughtful users of it. One way to do this is to establish collaborative networks around data utilization. Kent County's Professional Learning Community model highlights how collaboration can drive utilization.

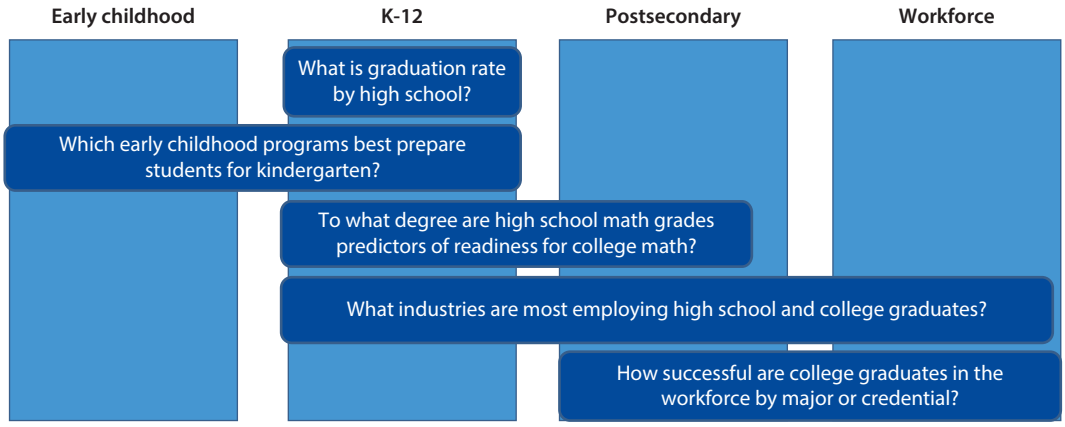
The federal government plays an important role in catalyzing a data-utilization ecosystem that reaches state and local levels and streams across private and social sectors. Across the United States, data utilization and open data are gaining momentum through platforms such as www.data.gov, www.cities.data.gov,

www.counties.data.gov, and www.states.data.gov. Government offices such as the U.S. Department of Education's Office of Planning, Evaluation, and Policy Development routinely publish informative content on a variety of topics, including education technology.[2] Such reports include "Teachers' Ability to Use Data to Inform Instruction: Challenges and Supports" (U.S. Department of Education, 2011) and "Use of Education Data at the Local Level: From Accountability to Instructional Improvement" (U.S. Department of Education, 2010).

The private and social sectors are also essential parts of this ecosystem. The Data Quality Campaign (DQC), a nonprofit organization, showcases the important role that the social sector can play in promoting effective utilization of education data. The private sector also plays an important part. EdSurge, an independent information resource and community for education-technology stakeholders, reported that education-technology startups in the United States raised a total of $1.85 billion through December 16, 2015 (EdSurge 2015). Within that figure, companies whose tools target K-12 accounted for $537 million, and those serving higher education raised $711 million. Across the ecosystem, additional organizations, solutions, and communities help to unleash the potential of data to drive learning.

When designing a new data system, start with the policy questions that key stakeholders want the data system to answer. Identifying and answering these questions early in the process can help reduce the risk of ending up with a fragmented and limited system. This strategy also helps to build consensus across departments and stakeholder groups that often have different incentive structures and desired outcomes. The Data Quality Campaign also suggests using critical policy questions as a basis for developing an agenda for effective data use to improve student achievement. Figure ES.2 illustrates how the group aligns critical questions with different educational stages.

Figure ES.2 DQC Critical Policy Questions



Source: Data Quality Campaign (DQC) presentation, World Bank Education Staff Development Program, February 2015.

About SABER-EMIS

Part of the World Bank's Education Sector Strategy, the Systems Approach for Better Education Results (SABER) is an evidence-based initiative that uses diagnostic tools to examine education systems and their component policy domains, and to measure them against global standards and best practices. By leveraging this global knowledge, SABER fills a gap in data and evidence on what are the most important factors for improving the quality of education and learning outcomes.

While information and data are essential components of a strong education system, many countries struggle with such issues as a lack of quality and timely data, as well as weak policies, data-system architecture, and utilization practices. These create barriers that effectively prevent educators from tapping the full potential of data systems to help monitor and improve education outcomes. SABER's EMIS domain seeks to expand the pool of available knowledge on effective data-system implementation. To deliver on this objective, SABER-EMIS identifies, benchmarks, and analyzes states and countries with strong data systems, and documents good practices so that others can learn from these experiences.

The EMIS domain also helps states and countries improve data collection, data and system management, and data use in decision making by assessing the effectiveness of a country's data system. The World Bank's EMIS project also provides recommendations on how countries could better manage education inputs and processes to achieve greater efficiency and stronger learning outcomes. Additional information about SABER-EMIS is available at the SABER website.[3] Other useful resources include a framework paper, "What Matters Most for Education Management Information Systems"[4] (Abdul-Hamid 2014), the SABER-EMIS Rubric,[5] and the Data Collection Instrument.[6] Country and state assessment reports and open data are also available on the SABER website.

Notes

1. NCES also tracked higher education data from its onset, though this aspect is not detailed in this report.
2. The U.S.-China E-Language Project: A Study of a Gaming Approach to English Language Learning for Middle School Students (2011).
3. http://saber.worldbank.org.
4. What Matters Most for Education Management Information Systems: http://wbgfiles.worldbank.org/documents/hdn/ed/saber/supporting_doc/Background/EMIS/Framework_SABER-EMIS.pdf.
5. SABER-EMIS Rubric: http://wbgfiles.worldbank.org/documents/hdn/ed/saber/supporting_doc/Background/EMIS/SABER_EMIS_Rubric.pdf.
6. Data Collection Instrument: http://wbgfiles.worldbank.org/documents/hdn/ed/saber/supporting_doc/Background/EMIS/SABER_EMIS_Questionnaire.pdf.

Abbreviations

ACARA	Australian Curriculum, Assessment and Reporting Authority
ARRA	American Recovery and Reinvestment Act
AYP	adequate yearly progress
CEDS	Common Education Data Standards
COMAR	Code of Maryland Regulations
COPPA	Children's Online Privacy Protection Act
DATA	Direct Access to Achievement
DCAA	Division of Curriculum, Assessment and Accountability
DCMI	Dublin Core Metadata Initiative
DLLR	Department of Labor, Licensing and Regulation
DQC	Data Quality Campaign
EDW	Education Data Warehouse
EFA	Education for All
EMIS	Education Management Information System
ESEA	Elementary and Secondary Education Act
ESRA	Education Sciences Reform Act
FERPA	Family Educational Rights and Privacy Act
HSA	High School Assessment
ISCED	International Standard Classification of Education
LDS	Longitudinal Data System
MHEC	Maryland Higher Education Commission
MLDS	Maryland Longitudinal Data System
MSA	Maryland School Assessment
MSDE	Maryland State Department of Education
MSPAP	Maryland School Performance Assessment Program
NAEP	National Assessment of Educational Progress
NCES	National Center for Education Statistics
NCLB	No Child Left Behind
ODE	Ohio Department of Education

P-20W	Preschool to the Workforce
PARCC	Partnership for Assessment of Readiness for College and Careers
PC	personal computers
PIRLS	Progress in International Reading Literacy Study
PISA	Program for International Student Assessment
RTTT	Race to the Top
SABER	Systems Approach for Better Education Results
SASID	State-Assigned Student Identifier
SDG	Sustainable Development Goals
SLDS	State Longitudinal Data System
SLO	student learning objective
SPI	School Progress Index
TEAMS	The Evaluation & Assets Management System
TIMSS	Trends in International Mathematics and Science Study
UID	unique identifier
USI	unique student identifier
WDCS	Web Data Collection System

Introduction

A 2015 World Bank report assessed education management information systems (EMISs) in the state of Maryland in the United States and uncovered a successful system, with an advanced enabling environment and quality data, as well as established system soundness and utilization practices (table I.1). "From Compliance to Learning: A System for Harnessing the Power of Data in the State of Maryland" expands on lessons learned in the Maryland assessment, with an emphasis on how they can be applied in practice across a broad range of education systems.

The goal of this report is to distill Maryland's good practices in education data systems and data utilization, and share them in a way that is useful to education stakeholders seeking to strengthen their use of data and information systems. Maryland's good practices are applicable to a broad range of data systems and levels of capacity, including those that are in a more nascent state of development. In fact, emerging data systems could potentially speed up their evolution and strengthen their ability to facilitate broad utilization in the future by adopting some of these practices.

The Role of Data in Education Systems

In general, systems are composed of components, processes, and subsystems, all reliant upon each other and all guided by a common purpose. Following a dynamic set of organized and rule-structured activities, systems transform inputs into desired outputs on an ongoing basis. Understandably, the success of a system depends on the effectiveness of interactions within that system.

Education systems generally are complex, open, and adaptive. They are **complex** in that they are diverse and comprise multiple interconnected elements. For example, public-education delivery, governance, and accountability structures usually include a national entity, such as a ministry of education or national department of education; regional entities, such as provincial or district offices; and local entities, such as schools. Adding to the complexity are private or charter schools, nongovernmental organizations, unions, and many other substructures

Table I.1 Maryland EMIS Rankings

1.	Enabling Environment	**Advanced** ●●●●
2.	System Soundness	**Established** ●●●○
3.	Quality Data	**Advanced** ●●●●
4.	Utilization for Decision making	**Established** ●●●○

Source: World Bank 2015.

that act within, and influence, the overarching system. Education systems are **open** because they interact and exchange content with external entities. For example, students flow into and out of an education system, as do information, resources and materials, knowledge products, and noneducational data, such as health data. Finally, education systems are **adaptive** due to their capacity to change and even learn from experience. Education systems are in a continual state of evolution. From pedagogy to policies, from management practices to financing, education stakeholders are often testing new models for various aspects of the system, looking to learn from lessons offered by external systems, and pushing boundaries to improve education-service delivery.

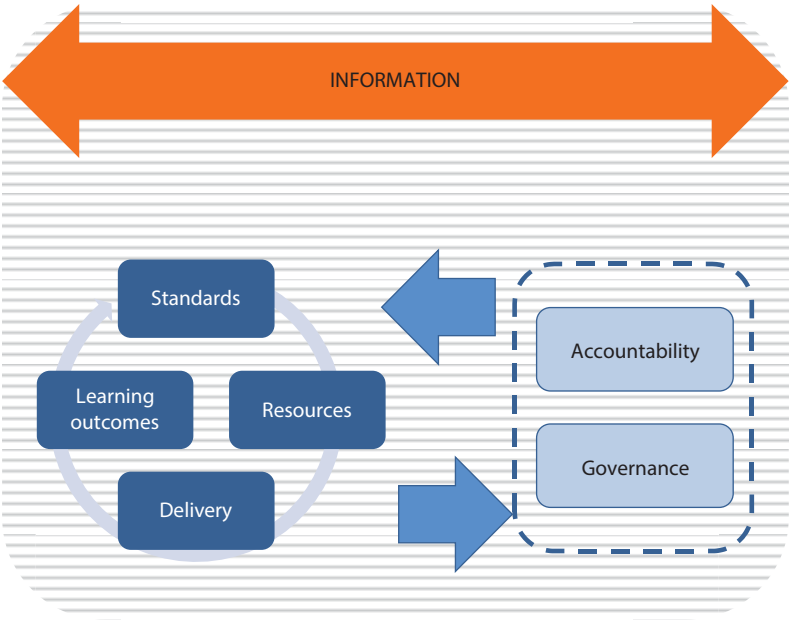
The adaptive nature of education systems, coupled with an effective flow of information, can ease challenges associated with their complexity. Information, often in the form of data, plays an integral role in education systems because it permeates the system, enabling connectivity and linkages among subcomponents, guiding processes, and informing stakeholders at all levels about the effectiveness of both the overarching system and their individual subcomponents.

Both policy makers and educators depend on information to guide their work. For policy makers, information is essential for determining whether the intent behind specific policies and programs aligns with implementation and intended outcomes. For teachers, principals, and administrators who work on the front lines of education, information guides school management and planning, as well as classroom instruction. Figure I.1 illustrates an adaptive education-delivery cycle in which information permeates the entire environment. **Standards** determine **Resource** allocation, leading to education-service **Delivery**, which results in **Learning Outcomes**, which in turn informs **Standards**. Guiding and monitoring each of the stages in this cycle are **Governance** and **Accountability**.

What Makes Learning Happen?

Ensuring education quality and learning is a priority across development agendas, including for the World Bank's Learning for All Education Strategy 2020, Education for All (EFA), and Sustainable Development Goals (SDGs). As the

Figure I.1 Information Permeates the Education System



World Bank strategy explains, the reason for prioritizing quality learning is simple: Growth, development, and poverty reduction depend on the knowledge and skills that people acquire, not the number of years that they sit in a classroom. Extensive evidence supports the claim that years of schooling alone have little impact on a country's economic growth; rather, quality education produces learning and yields the greatest returns (Currie and Thomas 1999; Hanushek and Kimko 2000; Hanushek and Wößmann 2007, 2015). However, a brief review of recent literature suggests that identifying and measuring the determinants of learning is both complicated and controversial.

Defining and measuring quality is difficult. Education economists and practitioners have produced numerous reports examining the various factors purported to influence—or not influence—student learning outcomes, from quality of teachers and curriculum design, to school resources and family characteristics. Policy makers are eager to use such evidence to develop policies and programs that target learning. Yet, establishing a strong base of evidence on the determinants of learning is not easy. First, a country must generate regular, high-quality information about student outcomes (Hanushek 2003). This remains a difficult task, especially for low- and middle-income countries. Second, numerous methodological challenges arise when trying to identify determinants of education quality. These include (1) separating quality of education from years of schooling, (2) separating school factors from nonschool factors, (3) identifying a satisfactory measure of quality such as achievement scores or value-added

models,[1] and (4) avoiding additional measurement errors, such as omitted variable bias, sample selection bias, attrition bias, and spillover effects. Ultimately, the complexity of education systems makes it extremely difficult to identify the exact impact of an intervention. Even when done successfully, it is dangerous to assume that the same intervention will carry similar effects in different education systems or environments. Still, a review of the literature reveals useful findings.

A variety of reports explore interventions that aim to improve learning by influencing families and communities. Gertler, Rubio-Codina, and Patrinos (2006) examined a federal government initiative in Mexico, Apoyo a la Gestión Escolar, which provided small grants to parent associations to invest in school infrastructure or materials. In addition to monetary funds, parents also received training in financial management and participatory skills. Using a combination of quantitative and qualitative methods, the authors showed that the initiative reduced grade repetition and grade failure by 4–5 percent, controlling for the presence of a conditional cash transfer program and other educational interventions. On a broader scale, Aturupane, Glewwe, and Wisniewski (2013) examined three different sources of data from Sri Lanka to investigate the determinants of reading and math skills among fourth-grade students. Findings showed that parents' education played a large role in determining learning outcomes. Other influential factors included early childhood nutrition, principals' and teachers' years of experience, the practice of grouping schools into "school families," and parent-teacher meetings.

A wealth of research examines the impact of school-level inputs on student learning. A number of studies have found that teacher effectiveness is a key predictor of student learning (Hanushek and Rivkin 2006; Rockoff 2004). According to Branch, Hanushek, and Rivkin (2013), highly effective principals raise the achievement of a typical student in their schools by between two and seven months of learning in a single school year, while ineffective principals reduce achievement by the same amount. Glewwe and Kremer (2006) demonstrate that the provision of official Kenyan government textbooks raised test scores for the top two quintiles of students, as measured by initial academic achievement, but had no effect on either the test scores or the dropout and repetition rates of average and below-average students. Various reports have also found that paying for school uniforms increased test scores while reducing dropout rates and incidences of teen marriage and pregnancy (Duflo et al. 2006; Evans, Kremer, and Ngatia 2009).

Yet the notion that targeted school-level inputs affect student learning is controversial,[2] and many argue that learning outcomes depend on the larger education-delivery system. Opponents warn against government policies that aim to increase quality by solely injecting resources into schools, without thoughtful attention given to how those resources should be used. This alternative approach advocates for organizational and incentive-based interventions, which resonates with the systems approach to education reform outlined in the previous section.

Heckman (1999, 42) touches on this systems approach when he describes the importance of a "life cycle approach" to evaluating human capital investment strategies. "It is crucial to consider the entire policy portfolio of interventions together—training programs, school-based policies, school reform, and early interventions—rather than focusing on one type of policy in isolation from the others." Wößmann (2000) uses a large, international student-level micro-database based on the Trends in International Mathematics and Science Study (TIMSS) to explore educational inputs, as well as institutional arrangements within an education system. Student-level estimations show that international differences in student performance are not influenced by inputs, but are considerably related to institutional differences, such as centralized examinations and control mechanisms, school autonomy in personnel and process decisions, individual teacher influence over teaching methods, limits to teacher unions' influence on curriculum scope, scrutiny of students' achievement, and competition from private schools.

Glewwe and Kremer (2006) point out that decentralization and school-choice programs offer some promise for education systems in developing countries, but their impact hinges on the details of implementation. The ability of accountability and autonomy to influence learning (Alvarez, Garcia-Moreno, and Patrinos 2007; Bruns, Filmer, and Patrinos 2011; Jimenez and Sawada 1999; King and Ozler 2005; Pradhan et al. 2011) also falls into the broader category of system-level interventions that influence learning.

As discussed in the previous section, information and data play an essential role in the broad education system because of their ability to enable connectivity and linkages among subcomponents, to guide processes, and to ensure an adaptive environment by informing stakeholders at all levels about the effectiveness of both the overarching system and their individual subcomponents. A handful of studies have examined the impact of information on student learning. Andrabi, Das, and Khwaja (2015) examined how information provision to parents and schools affected learning outcomes in a large-scale study conducted in Pakistan's Punjab Province. The study provided simple, accurate reports cards to households and schools in treatment villages, sharing test scores for children and all schools in the village. Average test scores increased by 0.10–0.15 of a standard deviation in the villages where report cards were distributed. With regard to the study, Bruns, Filmer, and Patrinos (2011, p. 71) note that the education data provided to parents is most effective when it is simple: "The priority should be on simple indicators that parents care about, that they understand, and that are likely to motivate them to action."

Rockoff et al. (2010) examine a pilot program conducted by the New York City Department of Education in which principals were randomly selected to receive objective performance measures (estimates of "value-added") for teachers at their schools, along with training on the methodology used to construct the estimates. In the context of this report and relevance to student learning, the most compelling finding was that after the provision of performance data, the probability of job separation increased for low-performing teachers, and that following the attrition, student achievement exhibited small improvements the

following year. Finally, the Oregon Direct Access to Achievement project (discussed below) provided evidence linking data utilization to student-learning outcomes (Dunn 2011).

Efforts that examine determinants of learning within the context of the education system present new measurement challenges, but continue to gain attention from researchers and practitioners. Continued analysis in this area will contribute to the ongoing quest to determine what factors enhance student learning.

What Is Necessary to Achieve Data for Learning?

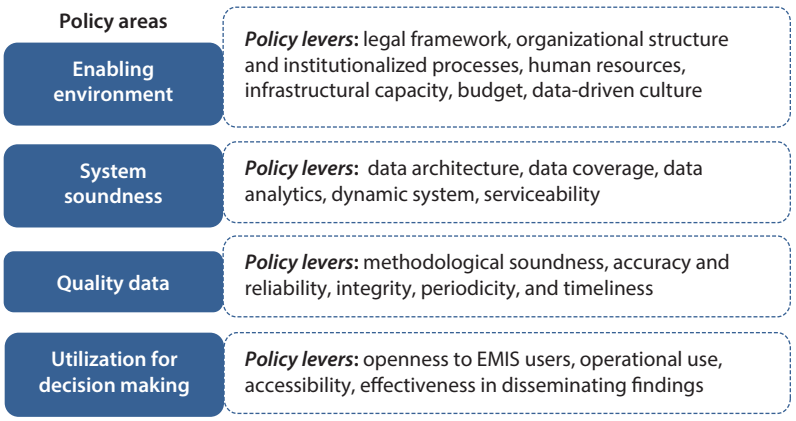
Data systems and capacity for data utilization vary; in fact, each data system and its users are unique. Despite these differences, an examination of data systems and utilization practices worldwide suggests that advanced systems share a set of key areas and characteristics. These areas and characteristics can provide a road map to stakeholders looking to strengthen and upgrade their own systems and utilization practices.

EMIS produces and monitors education statistics within an education system. Such a system has a multifaceted structure, comprising the technological and institutional arrangements for collecting, processing, and disseminating data (Abdul-Hamid 2014). An effective education data system is credible and operational in planning and policy dialogue as well as teaching and learning. It is crucial for tracking changes, ensuring data quality and timely reporting of information, and facilitating the utilization of information in decision making.

Policy Areas

Four key policy areas are essential to education data systems. Each policy area is defined by a set of policy levers (actions that help governments reach the policy goal) and indicators (measurements of the extent to which the policy levers are achieved) (figure I.2).

Figure I.2 SABER-EMIS Policy Areas and Levers



Source: Abdul-Hamid 2014.

A strong **enabling environment** lays the foundation for an effective system. Enabling environment refers to the laws, policies, structure, resources, and culture surrounding an EMIS that make data collection, management, utilization, and access possible.

System soundness ensures key processes, structures, and integration capabilities in an effective system. Education data are sourced from different institutions, but all data feed into, and make up, an overarching data system. Databases within an education information system are not viewed as separate databases, but as part of the whole system. Key aspects of system soundness include what data are being tracked and how these data points come together in the overarching system.

Quality data establish the mechanisms required to collect, save, produce, and utilize information in an accurate, secure, and timely manner. Data quality is a multidimensional concept that encompasses more than just the underlying accuracy of the statistics produced. It means that not only are the data accurate, but that the data also address specific needs in a timely fashion. Quality data lay the groundwork for effective utilization.

A successful data system is **utilized in decision making** by all users (parents, students, teachers, principals, and policy makers) across the education system. An education data system needs to be used to ensure measures are taken to improve education quality. Accurate information on education-sector performance enables more informed policies and programs, as well as enhanced management, planning, and instruction at the school level. To assess utilization, it is imperative to understand where decision making occurs, if the capacity to analyze and interpret education data exists, and if specific data are available to inform decisions.

Principles

Three principles guide an education information system to effectively reach learning outcomes: sustainability, accountability, and efficiency. Lack of these principles leads to breakdowns in the information system. Combined, the principles result in an effective information system that adds value to the broader education system.

Sustainability

Sustainability refers to the extent to which an education data system can provide value for the long term. Simply stated, "it is obvious that without sustainability there is no long-term use, and without long-term use there cannot be long-term impact on the classroom" (Crouch 1997, 214). Yet achieving sustainability is complex because it requires optimization at multiple levels, from the technology platform to the processes and institutionalization of the system, from budget to user capacity. Winkler and Herstein (2005, 1) argue that sustainability is linked to utilization and that the three key components to successful creation of a sustainable information culture are (1) reorientation of the education information system toward clients, (2) improved capacity to use

information at the local level, and (3) increased demand for information. Use of an education management system could be limited due to incompatibility with existing systems, customization of new systems, capacity of system staff, limited financial resources, or limited government commitment. Additionally, the sustainability of the system is negatively impacted if data are not needed or not relevant for decision making.

Accountability

This report uses the accountability definition and structures from the *2004 World Development Report*, which defines *accountability* as a set of relationships among service-delivery actors with five features:

- **Delegating:** explicit or implicit understanding that a service (or goods embodying the service) will be supplied
- **Financing:** providing the resources to enable the service to be provided, or paying for it
- **Performing:** supplying the actual service
- **Having information about performance:** obtaining relevant information and evaluating performance against expectations and formal or informal norms
- **Enforcing:** being able to impose sanctions for inappropriate performance or provide rewards when performance is appropriate.

The report goes on to define four relationships of accountability: client power (over providers), compacts, management (by provider organizations of frontline professionals), and voice and politics (between citizens and politicians or policy makers). These are further defined as the following:

- **Client power:** The relationship of accountability connecting clients to the frontline service providers, usually at the point of service delivery, based on transactions through which clients express their demand for services and can monitor supply and providers.
- **Compacts:** The broad, long-term relationship of accountability connecting policy makers to organizational providers. This is usually not as specific or legally enforceable as a contract. But an explicit, verifiable contract can be one form of a compact.
- **Management:** The relationship of accountability connecting organizational providers and frontline professionals, comprising internal processes for public and private organizations to select, train, motivate, administer, and evaluate frontline professionals. These processes may be rule-bound in large bureaucracies, or idiosyncratic and ad hoc in small, private providers.
- **Voice and politics:** The most complex relationship of accountability, it connects citizens and politicians and comprises many formal and informal processes, including voting and electoral politics, lobbying and propaganda, patronage and clientelism, media activities, access to information, and others.

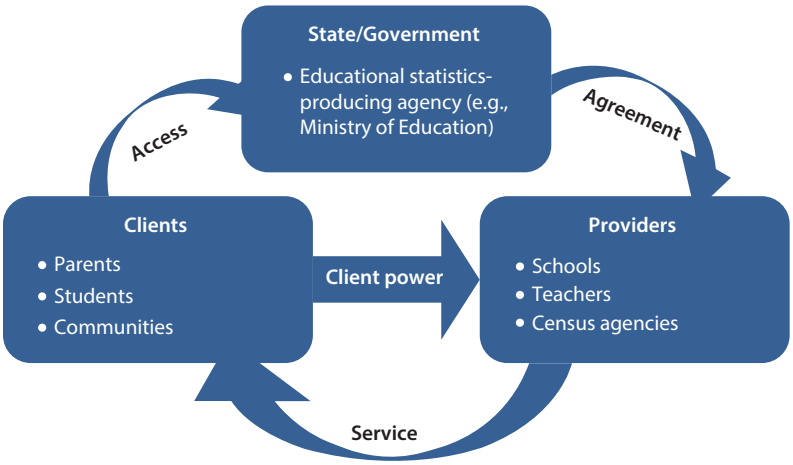
Applying this framework to education data, three accountability relationships exist among an information system, society, and education providers:

1. The education data system or state holds both policy makers and education providers accountable to society by requiring them to make informed, data-driven decisions
2. Clients hold the information management system accountable for collecting, maintaining, and disseminating quality data and reporting on those data and
3. Clients hold education providers accountable for providing quality education services.

Figure I.3 is adapted from a framework outlined by the World Bank (2004) regarding information and accountability relationships. Accountability relationships are complex due to individual interests and collective objectives, system-monitoring requirements, and inherent difficulties in attributing outcomes to specific actions. Accountability is considered a critical element of service delivery that influences the incentives of both the providers and recipients of information (Pritchett and Woolcock 2004). Before identifying data-quality concerns, it is first important to identify where decision making occurs within a system to assess where accountability pressures exist (Crouch, Enache, and Supanc 2001).

Shared access to education statistics is an important lever for accountability. Published information about education performance is the central government's only tool for informing society about the performance of the education sector. Accountability is improved when accurate and reliable education statistics are made available. This helps ensure that decision makers and policy makers rely more on data than on politics and opinion (Porta et al. 2011). The quality and accuracy of education data is, therefore, crucial, since society will trust only

Figure I.3 Role of Information in an Accountability Framework



Source: Adapted from World Bank 2004.

quality data (Barrera-Osorio and Linden 2009). By promoting more efficient and transparent use of resources, the combination of better-informed decisions and increased accountability paves the way for better-quality outcomes in an education system (De Grauwe 2005).

Efficiency

In the context of an education system, efficiency refers to the balance of financing (inputs) that the government and citizens contribute to produce quality education, and workforce skills (outputs). Generally, efficiency is greatest when the lowest amount of inputs produce the highest amount of outputs. In the context of education data and information systems, efficiency refers to effective maintenance of education statistics and records so that decision makers understand the balance of inputs and outputs and make decisions accordingly. An efficient education data system is necessary to support overall education management; inefficiency is a symptom of poor performance (World Bank 2004).

Data-driven decision making can help bring about more efficient spending. One of the motivations for governments to create an information management system is to improve the efficiency of the education system, that is, to "address issues of redundancy or improved targeting of resources [which] typically require a greater degree of data accuracy and precision" (Crouch, Enache, and Supanc 2001, 46). By utilizing existing databases and data collection processes that are familiar to users while reducing redundancies, cost-efficiency is enhanced in the long term (ibid.). Also, as noted in the funding model for the Global Partnership for Education's 2015–18 replenishment campaign, there is a need to "develop better evidence-based policies and enable more efficient expenditure decisions" that "requires conscious and well-funded efforts to strengthen national information systems" (Global Partnership for Education 2014, 16).

Additional Functionalities

Additional functionalities and characteristics of an effective data system include a dynamic system, an information cycle, and integration. These characteristics are increasingly important in the era of open data and integrated, compatible systems. An education data system cannot be fully effective without incorporating these key aspects.

Dynamic System

A dynamic information system is elastic and easily adaptable to allow for changes and advancements in data needs (Abdul-Hamid 2014). Its qualities should include the following:

- **Quality-assurance measures.** The system is dynamic and maintains quality-assurance measures. The system follows and implements an internationally accepted quality-assurance management approach, such as ISO 9000,

Total Quality Management. The performance of internal and external reviews helps to maintain quality. The system has processes in place that focus on data quality, collection monitoring, processing and dissemination of education statistics, and inclusion of data quality in statistical planning.

- **Mechanism to address new data requirements.** Mechanisms are in place to respond to new and emerging data requirements. Processes also exist to deal with quality considerations in planning education data system processes. System stakeholder and other data users periodically review the existing portfolio of education statistics and attendant statistical reports, and identify any emerging data requirements. The system allows for easy aggregation or disaggregation of data and has the ability to adapt to new or emerging data requirements.

- **Adaptability to change.** The system has the ability to adapt to changes and advancements in the education system, including advances in technology. Changes could also include new arrangements in schools, or added functionalities, such as new reported data for a specific school. If the method of collecting data changes due to a new technology, the existing system can still house the data. For example, it would be able to create and integrate a new category of students within the existing warehouse, if needed. The system is also able to work with preexisting components, such as legacy systems.

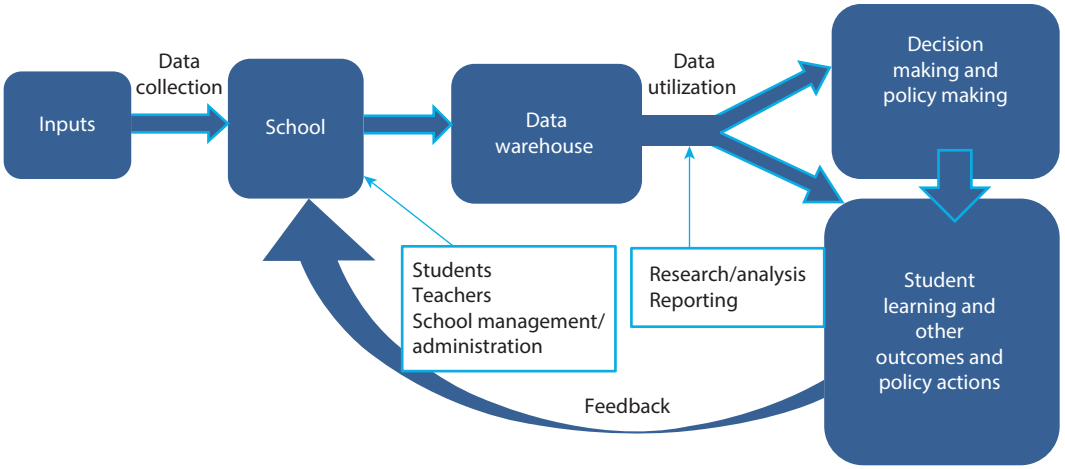
Information Cycle

The collection, maintenance, analysis, dissemination, and utilization of education data in an information system occur in a cyclical manner, which is referred to as the "Information Cycle" (Abdul-Hamid 2014). The system tracks inputs and helps assess the quality of policies and institutions, ultimately informing decision makers on student learning and other outcomes and policy actions. Information produced by the system is provided back to the data provider (e.g., schools) to be reviewed and acted upon, such as to make improvements. This also includes feedback on improving the effectiveness of the information cycle itself (figure I.4). Feedback about the collection and analysis process then informs the next information cycle (Al Koofi 2007).

Integration

Data collected by other agencies outside of the education data system, such as administrative data, population data, sociodemographic data, and sometimes geographic-information systems data, are integrated into the data warehouse; application program interfaces are important for this integration. Manual operations, such as data collected via nontechnological means, need to be integrated as well. Conversely, education system data may be integrated into databases and tools maintained by other agencies or institutions; however, this integration is not necessarily crucial to the functioning of an EMIS.

Figure I.4 Education Data System: Information Cycle



Source: Abdul-Hamid 2014.

Assessing a Data System from Policy Intent to Implementation

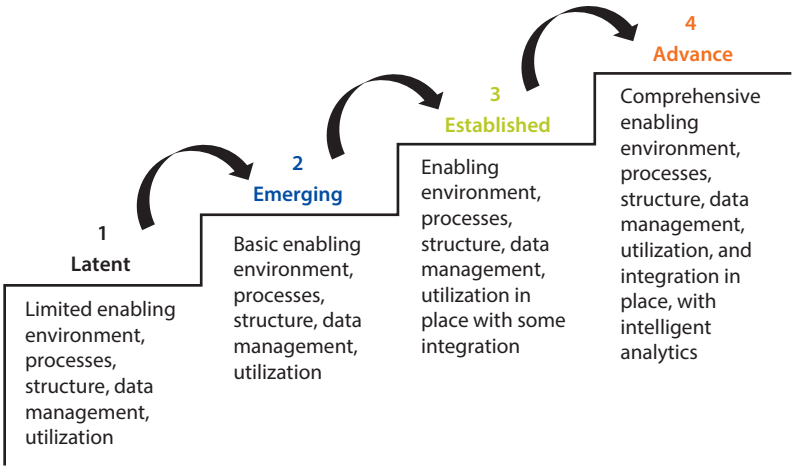
An effective data-system assessment takes into account the policy areas mentioned above, as well as any additional functionalities and characteristics. The SABER-EMIS assessment reviews policy levers be scoring them on a four-level scale (latent, emerging, established, and advanced) to assess the extent to which *both* policy intent and implementation on the ground are achieved (figure I.5).

Policy intent refers to the way in which the data system and its overarching purpose are articulated by decision makers and documented in policies and legislation, standards, and strategy documents. Assessing policy intent alone reveals only part of the picture. As such, the assessment also evaluates policy execution, or implementation. This is the degree to which policy intentions reach the day-to-day activities of stakeholders, including county administrators, principals, teachers, and students.

There are different ways to determine if policies are being implemented on the ground. Factors to look at include utilization by stakeholders, budget allocation, and distribution of human resources. Others include availability of professional development activities, communication and dissemination of information, and the extent of institutionalization across the system (figure I.6). An effective assessment examines how intent and implementation align to achieve system-wide effectiveness and efficiency by supporting management and planning as well as teaching and learning. Strong *adaptive* education systems will ultimately use outcome data to inform the effectiveness of policies and education strategies. They will also make adjustments as necessary, creating the cyclical process illustrated in figure I.6.

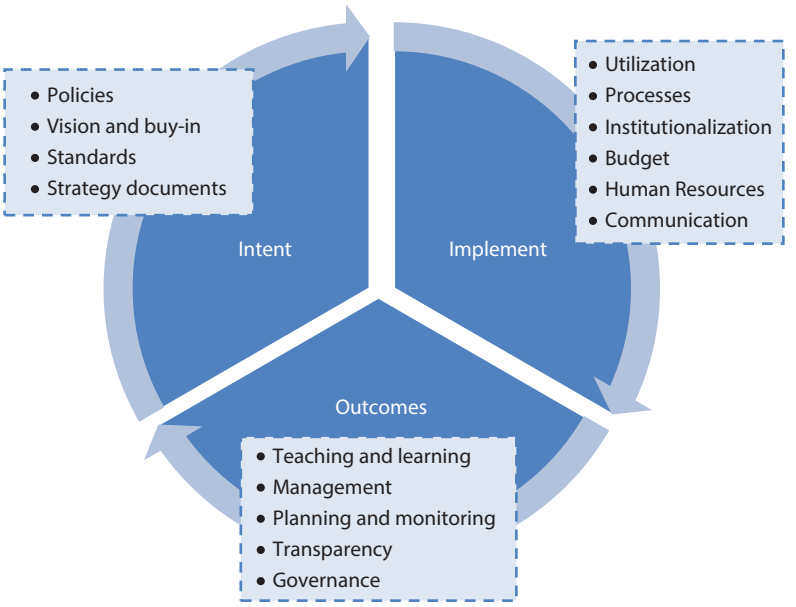
In Maryland, policy intent and implementation were assessed by the authors through desk research and analysis of system applications and utilization, as well

Figure I.5 SABER Scoring and EMIS Development



Source: Abdul-Hamid 2014.

Figure I.6 Policy Intent, Implementation, and Outcomes



as interviews with a variety of stakeholders (table I.2). The primary focus of the assessment was the state-level data system at the Maryland State Department of Education (MSDE), not individual county systems. The report examines county systems to assess implementation and to gauge the effectiveness of the overarching state policies and practices. While not the focus of the report, county systems also illustrate good practices, providing learning opportunities for readers.

Table I.2 Measuring Policy Intent and Implementation

Policy intent	*Implementation*
• Multiple meetings with MSDE • Extensive review of relevant federal, state, and county policies • Researched relevant standards and state planning documents • Found and compared federal and state grant applications and follow-up reports on utilization of grant funding	• Interviews with stakeholders at state, county, and local levels • Classroom observations • EMIS vendor demonstrations (county level) • Review of county systems (e.g., data warehouse, student information system, learning management system) • Analysis of data quality and comprehensiveness • Thorough utilization assessment • Examination of professional development activities and outcomes

Research and investigation for the Maryland data system assessment took place between August and December 2014. The authors conducted a comprehensive review of federal, state, and county policies, as well as technical documents and other background materials. To further examine intent and implementation, they conducted a series of interviews and meetings with the following entities:

- MSDE
- Purposeful sample of public school systems, including Anne Arundel County, Cecil County, Charles County, Harford County, Howard County, Kent County, and Montgomery County
- Sample of schools
- Maryland Longitudinal Data System Center.

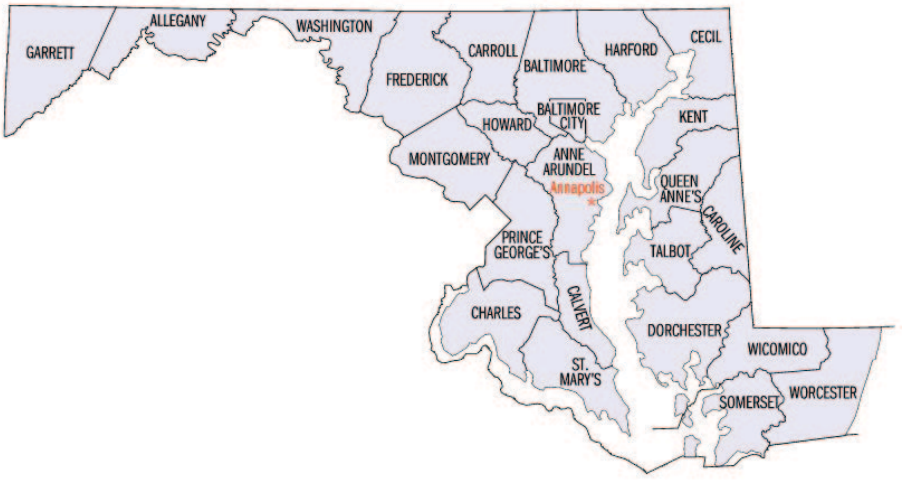
The authors selected the counties using purposeful sampling based on the stage of education data system development, as well as population and budget characteristics. The report focuses on seven of Maryland's 24 counties; these seven account for more than 25 percent of the total number of school systems in the state. Map I.1 provides a map of Maryland's counties, with blue stars indicating counties that are featured in this report.

Context: United States

In the United States, states have direct oversight over most aspects of the public education system, performing political, administrative, and fiscal functions that are often the work of ministries of education in countries with centralized education systems (U.S. Department of Education 2008).

Policies at the state level define the education system within each state, including critical factors such as curriculum, assessments, teacher qualifications, and resource distribution, as well as what data are collected and when the data must be reported. Local education agencies at the county or district level

Map I.1 Counties in the State of Maryland

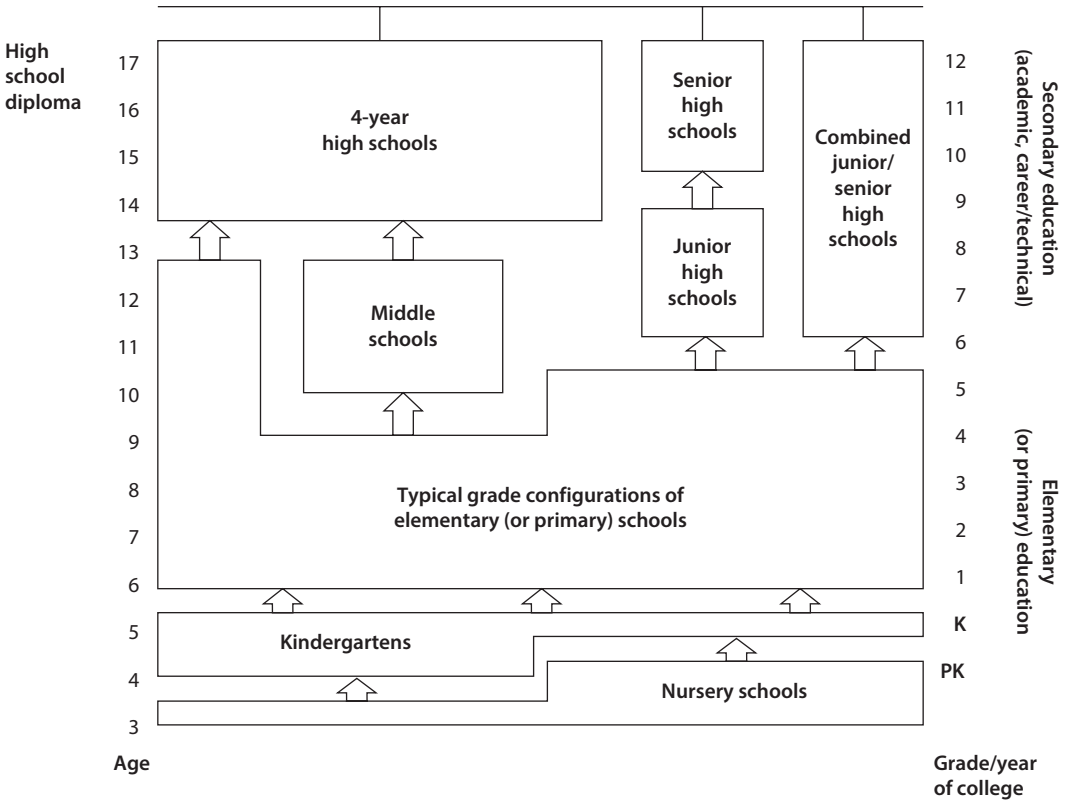


implement and enforce these requirements. Operating local school systems, they also develop and implement their own policies, hire and supervise teaching staff, and raise money. The structure of local agencies varies by state and region, but the agencies are generally managed by a governing body referred to as the school board. Education data often play a central part in school board decision making.

Given this decentralized education system, education management systems vary significantly from state to state. In some states, they differ from county to county. All state systems report data to the federal government based on predetermined schedules. And because all states structure their school systems in the same way, the state data warehouse provides comparable information. Under the U.S. public school system, schools provide education services for children in prekindergarten through 12th grade. Elementary school (primary) serves students in kindergarten to grade 5; middle school, grades 6–8; and high school (secondary), grades 9–12 (figure I.7).

The National Center for Education Statistics (NCES) is the primary federal entity responsible for collecting and analyzing data related to education in the United States and other nations (NCES 2015b). It operates under the U.S. Department of Education and the Institute of Education Sciences. The Center fulfills a congressional mandate to collect, collate, analyze, and report complete statistics on the condition of American education; conduct and publish reports; and review and report on education activities internationally. According to the Center, roughly 10 percent of all U.S. students attend private schools (table I.3). To gather private school data, the Center has conducted the Private School Universe Survey[3] every two years since 1989. The survey generates biennial data on the total number of private schools, teachers, and

Figure I.7 U.S. Education Structure, through High School



Source: U.S. Department of Education, National Center for Education Statistics, Annual Reports Program. http://nces.ed.gov/programs/digest/d13/figures/fig_01.asp. Accessed January 4, 2016.

students, and provides a list of private schools to serve as a sampling frame for additional NCES analysis.

School-system revenue is generated by federal, state, and local sources, with the majority of funding coming from state and local entities. The federal government is expected to supplement this funding, with a focus on increasing equity by providing additional funding to underserved school systems. Most federal funding is set annually through the congressional appropriations process. State funding comes primarily from income and sales tax revenues, while local funding comes from property tax revenues.

An interesting education reform in the United States is the formation of charter schools. The concept of charter schools—initially designed as legally and financially autonomous public schools—emerged in the 1970s and 1980s. The movement has gained steady momentum over the past several decades, with roughly 5 percent of public school students nationwide enrolled in charter schools (NCES 2015b). According to the U.S. Department

Table I.3 U.S. Education Indicators at a Glance

Schools and enrollment		
Institution	*Schools*	*Enrollment*
Public pre-kindergarten through grade 8 (2012–13)	92,375	35.0 million
Public grades 9 through 12 (2012–13)		14.8 million
Public charter schools (2012–13)	6,100	2.3 million
Private pre-kindergarten through grade 8 (2011–12)		4.0 million
Private grades 9 through 12 (2011–12)		1.3 million
Percent of students in private schools (2011–12)		9.6%
	2013	2014
Attainment (%)		
High school completion	90	91
Bachelor's or higher degree	34	34
Master's or higher degree	7	8
Performance		
Proficient grade 8 reading (2013)	36%	
Proficient grade 8 mathematics (2013)	35%	
Mathematics literacy of 15-year-olds (PISA 2012)	481 (international avg. is 494)	
Graduation/dropout (%)		
Public high school graduation rate[a] (2011–12)		81
Percentage of 16- to 24-year-olds not enrolled in school who have not completed high school (2013)		7
Poverty (2013)		
Percentage of 5- to 17-year-olds in families living in poverty		20.7%
Pupil-teacher ratio		
Public schools		16.0
Private schools		12.5
Public school revenue and expenditure (2011–12)		
Total revenues		$620 billion
Total expenditures		$621 billion
Current expenditures per student[b]		$11,014

Source: NCES 2015b.

a. Graduation rate is based on the Averaged Freshman Graduation Rate.

b. Current expenditures refers to school operations and does not include capital outlay (expenditures for property, buildings, and alterations completed by school district staff or contractors) or interest on school debt. Expenditures are reported in constant 2013–14 dollars, based on the Consumer Price Index.

of Education (2015b), a public charter school is a publicly funded school that is typically governed by a group or organization under a legislative contract, or charter, with the state or jurisdiction. The charter exempts the school from certain state or local rules and regulations. In return for flexibility and autonomy, the charter school must meet the accountability standards outlined in its charter.

Context: State of Maryland

Maryland is located in the Mid-Atlantic region of the United States, bordering Delaware, Pennsylvania, Virginia, Washington, DC, and West Virginia. It comprises 24 counties and county-equivalents (though an independent city rather than a county, Baltimore City is considered a county-equivalent for most purposes), each with its own school district, which in total serve more than 866,000 students (table I.4). The state education system is governed by the State Board of Education, and the MSDE is led by the State Superintendent. The Department has three key offices: the Office of the Deputy for School Effectiveness, the Office of the Deputy for Teaching and Learning, and the Office of the Deputy for Finance and Administration (appendix A). The state-level education data system is managed by the Office of Teaching and Learning in the Division of

Table I.4 Maryland Education Indicators at a Glance

General information		
Number of counties in the state		24
Total public schools (2013–14)		1,448
Total nonpublic schools (2013–14)		1,425
Estimated state population (2013)		5,928,814
Enrollment		
Stage	2013	2014
Elementary (K–5)	322,048	327,994
Middle (6–8)	184,187	187,227
High (9–12)	256,836	253,589
Total (Pre-K–12)	859,638	866,169
Attendance (%)		
Elementary	95.5	95.7
Middle	95.1	95.4
High	92.5	92.7
Performance		
Grade 8 MSA, mathematics	67%	58.7%
Grade 8 MSA, reading	81%	76.9%
SAT (composite mean of 2,400 total points)	1,456	1,439
Graduation/dropout rates (%)		
Graduation (4-year adjusted)[a]	85	86.4
Dropout (annual)[b]	3	3
Dropout (4-year adjusted)[c]	9.4	8.4
Teacher qualifications (2013–14) (%)		
Less than bachelor's degree		0.5
Bachelor's degree		42.6
Master's or master's equivalent		37.6
Master's degree + 30 hours or more		19.3

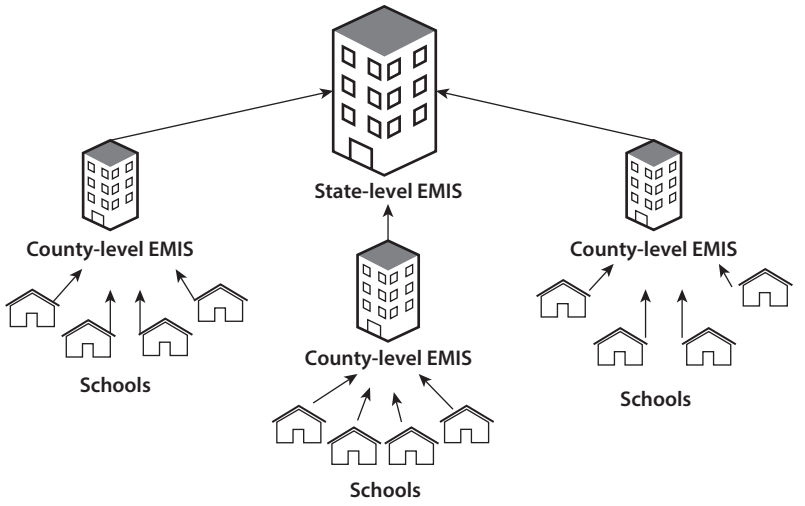
table continues next page

Table I.4 Maryland Education Indicators at a Glance *(continued)*

General information	
Expenditures (2013–14)	
Local operating budget from federal, state, and local sources (includes state-paid retirement)	$12.2 billion
Percentage of state budget spent on education	28.8%
Average spending per student	$13,572

Sources: MSDE 2014a, 2013–14; U.S. Census Bureau 2014.
a. Four-year adjusted graduation rate is calculated by dividing total diplomas earned by four-year adjusted cohort. Students who drop out of high school remain in adjusted cohort—denominator of calculation.
b. Annual dropout rate computed by dividing number of dropouts by total number of students in grades 9–12 served by the school.
c. Four-year adjusted dropout rate calculated by dividing total dropouts by four-year adjusted cohort. Students who drop out of high school remain in the adjusted cohort—denominator of calculation.

Figure I.8 EMIS in Decentralized Education Systems



Curriculum, Assessment and Accountability (DCAA). Maryland's decentralized education system creates a significant amount of variation in the management of education data across the state. The MSDE is the central collector of education data and is responsible for sharing county data with the federal government for compliance purposes (figure I.8).

Each county selects and manages its own information system that collects data from schools. The MSDE collects minimal data from private schools. Provision of data from private schools is voluntary, though most provide aggregate-level data. Funding provides some incentive, as any school that receives state funding must provide student-enrollment data. Private schools are also required to provide information when they absorb students who were previously in the public school system.

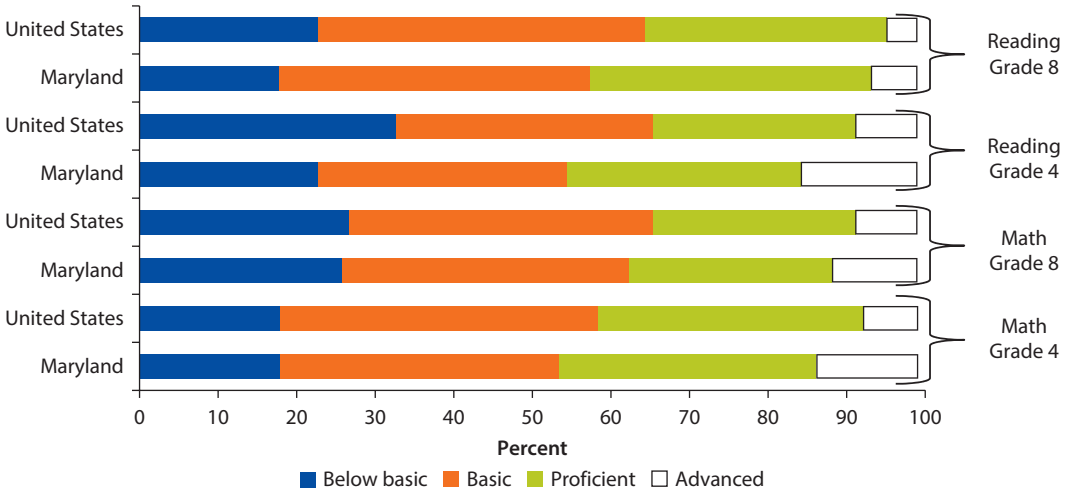
Maryland's public school system is among the highest-performing nationwide. It has ranked among the top three in the nation for the past eight years in *Education Week*'s "Quality Counts" report (*Education Week* 2015), and *U.S. News & World Report* (2015) rated the state first for best high schools nationwide. Additionally, for the last nine years, Maryland has ranked first in the percentage of public school students scoring a 3 or better on at least one Advanced Placement exam (*Baltimore Sun* 2015b).

Maryland students have also performed strongly on the National Assessment of Educational Progress (NAEP), a nationally representative and ongoing assessment of student performance across the United States. The assessment is administered by the U.S. Department of Education and disseminated via the Nation's Report Card (nationsreportcard.gov).[4] The 2013 NAEP achievement-level percentages showed Maryland public schools generally performing above U.S. public school averages (figure I.9). Maryland consistently performs strongly in the advanced category and also places well above U.S. averages in proficient reading for grades 4 and 8. Maryland also outperforms the national average in the below-basic category, with fewer students scoring in that category.

The national assessment is also used to compare U.S. results with those from international assessments, including Progress in International Reading Literacy Study (PIRLS), Program for International Student Assessment (PISA), and TIMSS.

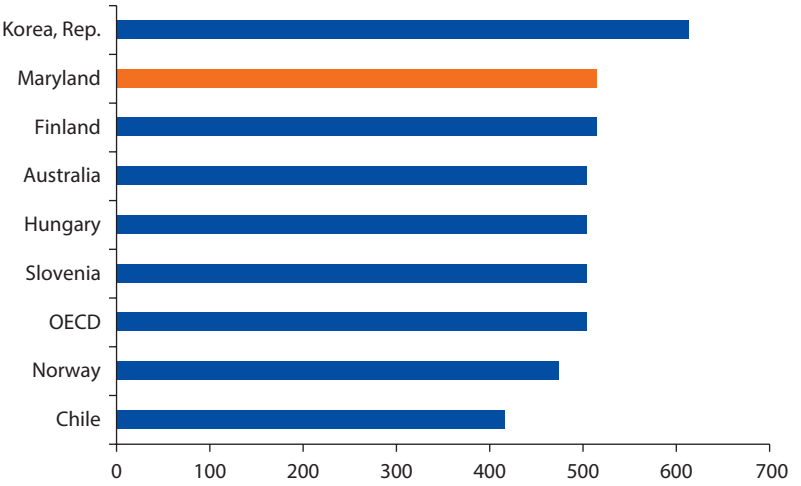
Maryland fares well in international assessments, reflecting a quality education system. For example, the NAEP-TIMSS Linking Study[5] predicted an average TIMSS score of 514 in Maryland for eighth grade mathematics and 528 for eighth grade science, which is higher than the average scores of Australia, Finland, Chile, Hungary, Norway, Slovenia, or OECD countries (OECD 2014) (figure I.10).

Figure I.9 NAEP Achievement-Level Results, Maryland and the United States



Source: www.nationsreportcard.gov.
Note: NAEP = National Assessment of Educational Progress.

Figure I.10 Maryland in International Context, Using TIMSS: Grade 8 Math Achievement, 2011



Source: Calculation using TIMSS 2011 database; NCES 2013.
Note: NCES = National Center for Education Statistics; OECD = Organisation for Economic Co-operation and Development.

According to a 2011 Harvard Kennedy School Report that used the NAEP to map PISA scores, 36.5 percent of Maryland students had an average score in math well above 530 (proficient in NAEP), and 10.1 percent had a score of 623 (advanced level in NAEP). This is much higher than the U.S. average, where only 32.2 percent of students had a score of 530 and 7 percent were in the advanced category. Countries whose performance levels are similar to that of Maryland include Austria, the Czech Republic, France, Hungary, Poland, the Slovak Republic, and Slovenia. Maryland's performance is also comparable to the top-performing states of Minnesota, New Jersey, and Vermont (Peterson et al. 2011).

Moving from Compliance to Learning and the Value of Information

At its core, the concept of moving from compliance to learning hinges on the way in which information is used in an education system. An education system that uses information for compliance purposes generally focuses on a narrow set of tests and resulting sanctions for those students, teachers, schools, districts, and states that fail to meet predetermined scores. As Darling-Hammond and Weingarten (2014) explain, the theory is that mandated testing schedules and legislated targets for improvement rates, coupled with the threat of tough sanctions, will yield progress in educators' efforts and, consequently, boost student performance. A compliance approach relies heavily on the negative incentive, the punishment, or the "stick." Evidence shows that, rather than improve learning, sanctions tend to reduce innovation and to incentivize schools to boost scores by holding back, or driving out, struggling students. They also drive thoughtful

educators from the profession, and disrupt learning for students whose local schools are shut down (Darling-Hammond and Weingarten 2014).

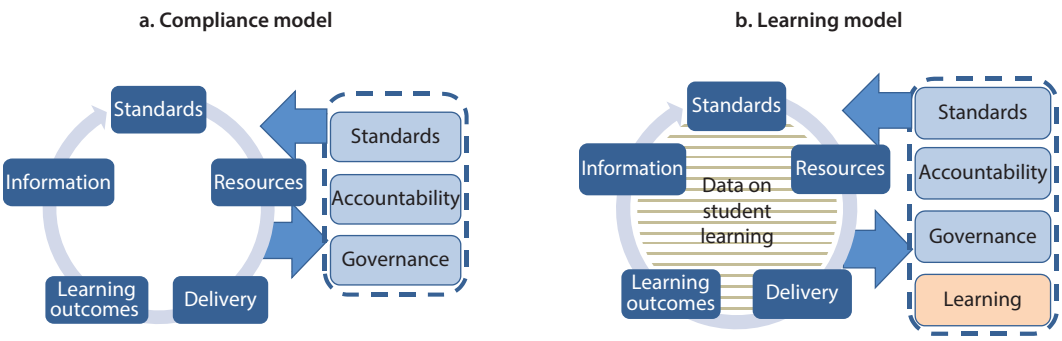
A learning approach, in contrast, uses information to support and improve a shared accountability model in which all stakeholders—policy makers, principals, teachers, school administrators, parents, and students—are responsible for student learning (Linn 2003). With this approach, Darling-Hammond and Weingarten (2014) argue, students get the most out of the system. Benefits include (1) curriculum, teaching, and assessment focused on meaningful learning; (2) adequate resources that are spent wisely; and (3) professional-capacity development that helps arm teachers and school leaders with the knowledge and skills they need to teach more challenging content in more effective ways.

Under the learning approach, stakeholders across the education system utilize information, with a focus on strengthening education system processes and practices to ultimately improve learning outcomes. Information ensures connectivity and linkages of inputs and activities across the system. For example, data on the quality of student learning play an essential role in each step in the education process, including (1) designing and evaluating policies and standards, (2) communicating and facilitating resource allocation, (3) enabling active, real-time utilization in classroom instruction, and (4) strengthening school management and planning (see figure I.11). Under the learning model, data also play a more multidimensional role in governance and accountability; instead of just penalizing poor performers—whether students, schools, districts, or states—data are used to actively guide improvements.

One example of the learning model in Maryland is the State's evolving accountability approach from Adequate Yearly Progress to a School Progress Index (discussed later in this report). The School Progress Index focuses on improving student achievement, closing achievement gaps, and preparing students for college and career by ensuring that they meet grade-level and course-level curriculum goals each year (MSDE 2012a).

The shift from compliance to learning finds its roots in the movement toward education quality. Information and data play a critical role in this context. An

Figure I.11 Moving from Compliance to Learning



education data system, when effectively structured, managed, and utilized, generates a variety of valued-added components that can improve quality by enhancing management, planning, and policy making, as well as teaching and learning. These value-added components include the following:

- **Data:** Data and related education statistics are necessary to provide quality education. Quality education is dependent on data and statistics, which inform policies, educational planning, management, and monitoring processes (Makwati, Audinos, and Lairez 2003, 9).
- **Efficient expenditure:** Information systems enable countries to be cost-efficient and effective in education planning and allocation of scarce resources.
- **Institutionalized data systems:** When guided by a clear vision and strategic plan, an education data system helps policy makers manage an education system to produce quality outputs.
- **Data-driven policies:** A data system can help policy makers and educators design and implement policies that are based on evidence and proven to reach intended outcomes.
- **Smart investments:** One of the recommendations made by the World Bank's Education 2020 Strategy is to invest smartly. An education data system can empower a decision maker to make smart spending decisions, based on data and analytics proven to contribute to learning (World Bank 2011).
- **Teaching and learning:** Teachers are increasingly drawing on information to assist them in instruction in the classroom (box I.1). This is part of a shift from summative-data use to formative-data use—a shift that depends on systems and data to create feedback loops that provide evidence to guide both teachers and school leaders (Halverson 2010).

Box I.1 A Data-Literate Teacher in Action

Urban Teacher Residency United's video "A Data Literate Teacher" profiles Micah O'Hare, Memphis Teacher Residency, as he uses data in the classroom. O'Hare explains that real-time data at the daily level, weekly level, and unit level are all critical to his teaching strategy. The data give him insight into his students' progress, helping him to customize his lessons. Data also help him decide how he allocates his time in the classroom, making him more efficient. "I know when I can release the majority of students to do something, and know that they can do it." Because of the data, he also knows "who are the three students in the room that need me to stop by and give them a quick reminder, while I watch and make sure that they can do that skill." O'Hare explains that he uses data through the lens of growth, as an active, real-time tool that puts information at his fingertips so he can more effectively meet the unique needs of each student. Data can also empower individual students to take ownership of their progress. "I like to use the data as a sales pitch," he says. "I use it to make success attainable for students."

Source: Urban Teacher Residency United 2014.

Notes

1. Value-added models examine student achievement over a set period, which enabled researchers to focus on, and better isolate, specific factors that influence student growth.
2. See Hanushek 2003; Nascimento 2008; Hanushek and Kimko 2000; Hanushek and Luque 2002; Wößmann 2000, 2001.
3. Private School Universe Survey: https://nces.ed.gov/surveys/pss/.
4. http://www.nationsreportcard.gov/about.aspx.
5. NAEP-TIMSS Linking Study: http://nces.ed.gov/nationsreportcard/studies/naep_timss/.

CHAPTER 1

Establishing a Strong Foundation

Data systems in the state of Maryland are bolstered by supportive policies, people, and processes at state and local levels. The Code of Maryland Regulations (COMAR) effectively positions the state-level data system managed by the Department of Education as the point-of-reference system that collects, processes, and disseminates education data on a regular basis. With a decentralized state education system, in which counties are autonomous and independent in many areas of decision making, the Code effectively regulates and empowers counties to build systems and innovate in relation to reporting, managing, and using data. In this way, the Code guides the systematic flow of data from schools to counties, and finally to the MSDE. Each county has its own data system, selected and managed independently by the county and integrated with the overarching state-level data warehouse. The strong legal framework lays the foundation for key ingredients that contribute to Maryland's advanced enabling environment. These ingredients include talented human resources, a dedicated budget augmented by federal and state partial funding, and a statewide data-driven culture. Powered by clear vision from high-level decision makers and solid buy-in from leaders across the education system, data systems and data utilization in Maryland have evolved from a focus on compliance to a more innovative, learning-focused approach. New institutionalization strategies and incentive structures put Maryland at the forefront of the national trend to harness data for learning.

Legal Framework and Policies Ensure Sustainable Data Systems

Legal Framework at the Federal Level

At the federal level, three policies have helped to shape education data systems in the United States: (1) the Elementary and Secondary Education Act (ESEA) of 1965, reauthorized in 2001 as the No Child Left Behind (NCLB) Act; (2) the Family Educational Rights and Privacy Act (FERPA); and (3) the Children's Online Privacy Protection Act (COPPA) (table 1.1).

Table 1.1 Federal Legislation Influencing EMIS

Federal legislation	*Summary descriptions*
ESEA/NCLB[a]	Provides funding, promotes equal access to education, establishes standards, and provides accountability. Also provides an opportunity to move from data for compliance to data utilization for student-learning outcomes.
FERPA[b]	Protects the privacy of student educational records. Applies to all schools that receive funding from the U.S. Department of Education.
COPPA[c]	Governs the collection of information that is gathered online from children under age 13 and applies to the operators of websites and online services directed at children. COPPA is enforced by the Federal Trade Commission.

Sources: U.S. Department of Education; Federal Trade Commission.
a. http://www.ed.gov/esea.
b. http://www2.ed.gov/policy/gen/guid/fpco/ferpa/index.html.
c. https://www.ftc.gov/enforcement/rules/rulemaking-regulatory-reform-proceedings/childrens-online-privacy-protection-rule.

The first, now known as NCLB, outlines accountability steps that have critical implications for education data systems. Key legislation is included in *Improving Basic Programs Operated by Local Education Agencies*[1] (ESEA/NCLB Part A, Section 1111), which specifically mandates the following:

- Each state must have a statewide accountability system that ensures all local educational agencies, public elementary schools, and public secondary schools make adequate yearly progress toward the state's student academic achievement standards.
- Each state must define adequate yearly progress in a manner that is statistically valid and reliable.
- Each state must establish statewide, annual measurable objectives and intermediate goals to meet objectives.
- Each state must develop a uniform averaging procedure to track the progress of schools toward reaching adequate yearly progress.
- Each state must establish a set of high-quality, yearly student academic assessments that, at a minimum, assess mathematics, reading or language arts, and science. Such assessments will serve as the primary means of determining the yearly performance of the state toward meeting its student academic achievement standard.
- Each state educational agency may incorporate the data from the assessments into a state-developed longitudinal data system that links student test scores, length of enrollment, and graduation records over time.
- Each state that receives federal government assistance must prepare and disseminate an annual state report card in a concise, understandable, and uniform format.
- Each state must collect and disseminate information in a manner that protects the privacy of individuals.

Several other key federal policies and grant initiatives have supported states in reaching data targets. Race to the Top (RTTT), a $4.35 billion education

initiative that is part of the American Recovery and Reinvestment Act (ARRA) of 2009, builds on a framework of comprehensive reform in four core areas. These focus on adopting rigorous standards and assessments that prepare students for success in college and the workplace; recruiting, developing, retaining, and rewarding effective teachers and principals; building data systems that measure student success and inform teachers and principals how they can improve their practices; and turning around the lowest-performing schools.

The Education Sciences Reform Act (ESRA) of 2002 initiated the Statewide Longitudinal Data Systems (SLDS) Grant Program to support the development and implementation of states' longitudinal data systems, as well as the expansion of K-12 systems to include data from preschool to the workforce (P-20W). The program also seeks to help states, districts, schools, and educators make data-informed decisions aimed at improving student learning. As of 2012, the program had awarded grants totaling $514 million. Maryland received three such grants, totaling $5.69 million (2006), $5.99 million (2009), and $3.96 million (2012). To drive state-level implementation of the longitudinal data system, Maryland enacted the Maryland Longitudinal Data System Act (Chapter 190, Senate Bill 275) in 2010. The Maryland Longitudinal Data System is a statewide data system containing select data on students at all levels of education and extending into the workforce.

Legal Framework at the State Level

At the state level, the COMAR ensures compliance with, and implementation of, state law. It is the key policy document that defines and guides Maryland's data management system. The Maryland Code effectively establishes state-level compliance with federal legislation. Specifically, its Title 13A[2] mandates data supply by requiring all schools to maintain a system of information on enrollment, attendance, and promotion of students to track annual measurable objectives, the annual performance targets established by the State Board. The Code also includes timelines for reporting, as well as penalties if data are not reported, or if data are intentionally misreported.

The Division of Curriculum, Assessment and Accountability[3] is responsible for the state-level education data warehouse. The Division's responsibilities include (MSDE 2013–14) the following:

- Administration of the Maryland School Performance Program's annual Report Card. These annually collected data provide accountability on the state, school system, and school levels.
- Facilitation of several divisions within the Department and local school systems for the development, administration, scoring, and reporting of all assessments, as well as provision of support in monitoring adherence to test-security requirements.

- Maintenance of the education data warehouse, and collection of data from local school systems and other entities. The Division also oversees the validation, definition, and maintenance of multiyear data in accordance with Department and Division policies and procedures to ensure data quality and accessibility.

Since the ESEA passed in 1965, data supply and utilization in Maryland (and across the United States) have been moving from a compliance-driven approach toward a learning-driven approach (table 1.2). Several early policies positioned Maryland as a pioneer in using education data, not just to comply with federal policies, but also to inform instruction at the school level, according to Dr. Jack Smith, Chief Academic Officer, Office of Teaching and Learning, Maryland Department of Education (Interview with Authors 2014).

In 1972 Maryland passed an educational accountability law that mandated statewide goal-setting and testing (Michaels and Ferrara 1999). Dr. Smith says the innovative approach was ahead of the curve. Under the new law, Maryland school systems reported their performance through on nationally normed tests, and the MSDE published an assessment accountability testing program report—a precursor to today's report card—for every school and school system. Michaels and Ferrara (1999, p. 103) agreed with Dr. Smith's statement: "Although school report cards are fairly common today, in the 1970s it was innovative and even revolutionary to provide a public accounting for the performance of individual schools."

In 1977 Maryland implemented Project Basic to account for gaps in the Maryland Accountability Testing Program report, such as a lack of attendance information and disaggregated performance data. Project Basic had two primary components: (1) a basic skills framework of 165 competencies that all schools were required to cover by the end of grade 8 and (2) minimum competency tests in reading, writing, math, and citizenship that students must pass to receive a high school diploma.

Table 1.2 Compliance- versus Learning-Driven Data Systems

Compliance-driven	*Learning-driven*
• Narrow focus on reporting data to comply with state and federal policies	• Use of data to inform instruction, especially at classroom level, with high levels of teacher utilization
• Lack of integration	• Use of data to inform management at all levels, including school, county, state, and federal
• Limited utilization, especially in the classroom	• Use of data to predict at-risk youth and intervene early
• Focus on summative assessments to evaluate learning, such as through state and national assessments, not formative assessments to monitor learning and growth, such as through quizzes	• Highly integrated data comprising administrative, learning (formative and summative assessments), human resources, and financial data used to fully understand how inputs impact outcomes

Note: Summary list, not exhaustive.

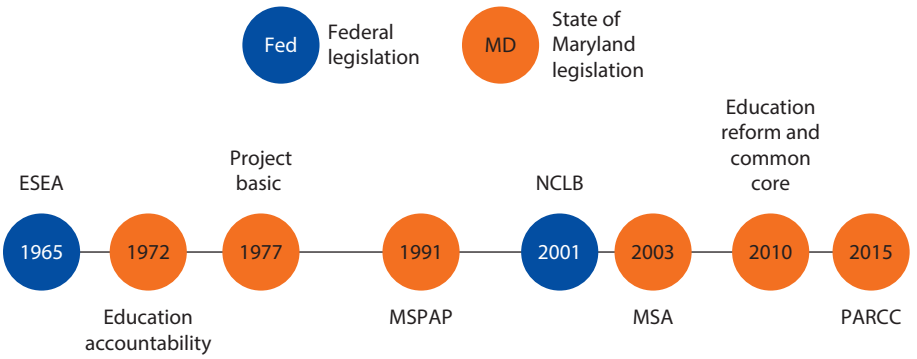
In May 1991 the state administered the Maryland School Performance Assessment Program (MSPAP) for the first time, testing approximately 150,000 students in grades 3, 5, and 8. Maryland used performance results for the MSPAP to evaluate schools and provide information to guide school-improvement efforts.

In 2001, these early efforts received further support at the federal level with the reauthorization of the ESEA as NCLB, which mandated annual testing, reporting of individual student results, and disaggregation of results by race and special services groups. Between 2003 and 2015, Maryland adopted a series of curriculum and assessment reforms, which used assessment data not just to comply with federal policies, but also to guide instructional improvement.

In 2003 the Maryland School Assessment (MSA) program launched. The state used results to evaluate school performance, guide school improvement, and inform instruction. In 2010, the Maryland General Assembly passed the Education Reform Act, and the State Board of Education adopted the Common Core State Standards, a more rigorous and thinking-based set of content standards. Dr. Smith explained that adoption of the Common Core–based assessments marked a critical shift to measure student-learning growth for both school accountability and educator evaluation. The Common Core curriculum introduced the need for a new assessment; thus, in 2015, Maryland administered the Partnership for Assessment of Readiness for College and Careers (PARCC) assessment for the first time. Figure 1.1 provides a timeline of policies that have influenced Maryland's education data systems.

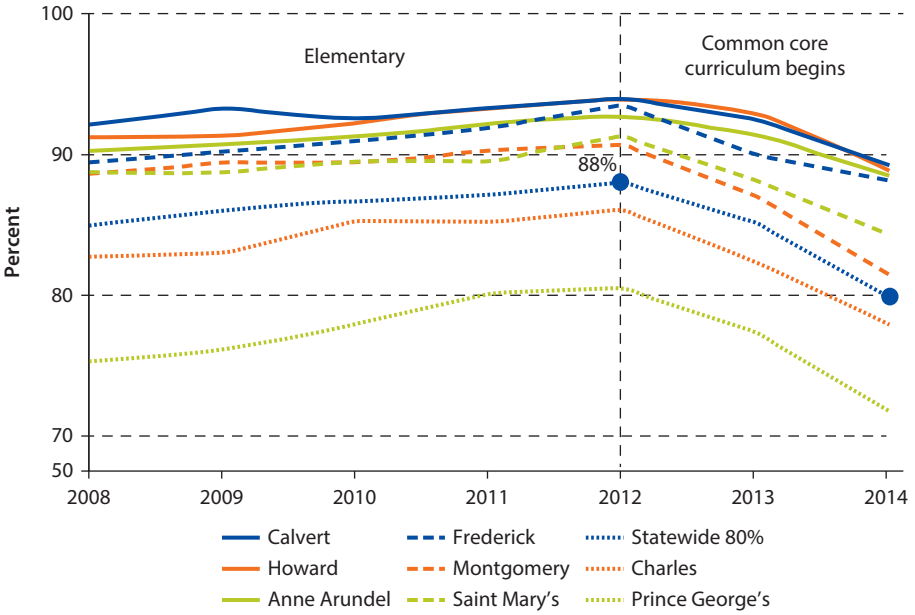
Maryland's recent curriculum- and assessment-reform process underscores the importance of a sound data system that accurately collects, analyzes, and distributes assessment data, and can also track the alignment of curriculum and assessment results. In 2013 data on the MSA revealed a decline of 5 percentage points for elementary students and nearly 7 points for middle school students

Figure 1.1 Timeline of Influential Policies



Note: ESEA = Elementary and Secondary Education Act; MSA = Maryland School Assessment; MSPAP = Maryland School Performance Assessment Program; NCLB = No Child Left Behind; PARCC = Partnership for Assessment of Readiness for College and Careers.

Figure 1.2 EMIS Tracks Decline in State Assessment Results during Curriculum Reform



Source: Wiggins and St. George 2014.

(figure 1.2), a result of the shift to new academic standards that were not yet fully aligned with assessments. State and county educators anticipated the alignment gap, and an effective data system was able to verify it, while continuing to provide important information about the achievement of specific student groups, classrooms, and schools. Maryland responded to the release of the data immediately, conducting outreach to schools and parents to explain the reform process and the reasons for the decline in scores.

Maryland's Anne Arundel County has been at the forefront of implementing the Common Core Standards and the PARCC assessment. Data shared via the county's data management system have played a central part of this implementation process, providing constant feedback on the ability of teachers to teach the new curriculum, as well as on students' success in learning it. Following the decline in MSA results, George Arlotto, Superintendent of Anne Arundel County, remarked, "There remains in these results data that is useful to administrators, principals, and teachers as we continue to move forward." (Interview with Authors 2014)

Comprehensive and quality data are established through policy and reinforced with regularly updated manuals. The Maryland Student Records System Manual,[4] updated and approved for publication in May 2015, provides instructions and sample forms to assist in the maintenance of required information on enrollment, attendance, and promotion. In a decentralized system, this type of

instructional manual is essential to ensuring that county-level data—stored in a myriad of different information systems, often using different software—can integrate with the state-level data system.

A legal framework stipulates the processes for sharing and reporting data from county to state, and state to federal government, including timelines and penalties for failure to comply. Additionally, the Maryland Longitudinal Data System Act positions the Maryland Longitudinal Data System Center to serve as a central repository for student and workforce data. This includes data sets provided by the following:

- Maryland State Department of Education
- Local education agencies
- Maryland Higher Education Commission
- Institutions of higher education and
- Maryland Department of Labor, Licensing and Regulation.

The legal framework does not specify nor encourage data sharing among local education agencies, a factor that contributes to high levels of variation in the quality and scope of the data systems among counties. Differences in budgets also contribute to variation. In some cases, counties with fewer resources have opportunities to collaborate with wealthier, neighboring counties and share resources and good practices. Currently the legal framework does not explicitly support this type of collaboration. At the state level, the budget for education data systems is spread out and separated by vendor, generally comprising roughly 15–20 line items (MSDE staff in interview with authors 2014).

Maryland's legal framework emphasizes data utilization, transparency, and date-driven decision making. Martin O'Malley, who served as governor from 2007 to 2015, championed a number of policies and programs that supported data-driven policy making, goal setting, and tracking. These initiatives include the Longitudinal Data System Act, the Open Data Policy, as well as programs such as StateStat,[5] a data-based management approach to make Maryland's government more effective and accountable. According to the Data Quality Campaign (DQC), a nonprofit organization committed to improving the availability and use of high-quality education data to improve student achievement, Maryland has now completed eight of 10 Actions to Ensure Effective Data Use,[6] compared with four in 2011.

The legal framework ensures confidentiality of Maryland respondents' data through a variety of federal and state policies. At the federal level, key policies include the FERPA[7] and the COPPA.[8] A number of state policies mandate further requirements in managing and accessing student data, especially the Code's Maryland Student Records Regulations (COMAR 13A.08.02). Privacy statements exist on both the Maryland State Department of Education website[9] as well as the Maryland Report Card website.[10]

Institutionalizing a Data System: Organizational Structure, Roles, and Responsibilities

Clear organizational structures, roles, and responsibilities are a central component of institutionalization. At the state level, the Division of Curriculum, Assessment and Accountability maintains the Education Data Warehouse. It oversees the collection of data from local school systems and other entities, as well as the validation, definition, and maintenance of multiyear data in accordance with documented policies and procedures to ensure data quality and accessibility (MSDE 2003). The Office of Accountability consists of an Analysis and Data Systems branch, an Accountability Support Services branch, and a Research and Evaluation branch (appendix B). Technical experts staff each branch.

At the county level, organizational structures vary due to high levels of autonomy. In some cases, a Chief Accountability Officer manages the data system; in other cases, it may be a collaboration between the technology and business departments. Most counties track performance of their educational strategies using education data. Additionally, processes for collecting, managing, and reporting data are documented, and responsibilities for associated tasks are assigned. At both state and local levels, the staff working on the data system are well qualified for their positions. Often system teams consist of staff with advanced degrees and technical skills, including doctoral and master's degrees. The teams also often include statisticians, data analysts, and database-architecture experts. At times, technical experts are hired as contractors to perform specific, highly technical, short-term tasks.

Across the public, private, and social sectors in the United States, an array of organizations, associations, and communities helps to expand and institutionalize data utilization by strengthening data standards and easing interoperability issues. In a 2013 report, the State Educational Technology Directors Association, which serves, supports, and represents U.S. and territorial educational technology leadership, classified these actors and interventions into three categories: (1) Consistent Data Definitions, (2) Sharing of Information across Systems, and (3) Search, Alignment, Discovery of Education Resources.

The first category, Consistent Data Definitions, focuses on providing a common language and structure for data, a necessary step that makes it possible to share data across different systems and applications. Structuring data so that the data can be used across different systems makes institutionalization possible. From an international perspective, UNESCO's International Standard Classification of Education (ISCED)[11] is a similar framework that enables comparisons of education statistics and indicators across countries on the basis of uniform and internationally agreed definitions. ISCED 2011 is the most recently revised version of the framework.

The second category, Sharing of Information across Systems, facilitates movement of data between applications without needing to alter the data.

Whereas the first category established common practices in defining data, this category focuses on software that guides the movement of data. Depending on the state of development of a data system in a country, the flow of data across an education system may consist of both technical and nontechnical processes. The central government plays an important role in helping to guide this flow of data through policies, training, validation, and dissemination. Regardless of a data system's stage of development, decision makers are wise to consider the movement of data across the education system and make efforts to streamline the process. This is an essential part of institutionalizing a data system. In its absence, data become siloed, quality diminishes, and utilization levels drop.

The third category from the report, Search, Alignment, Discovery of Education Resources, consists of initiatives that augment the process of finding appropriate resources, including standards-aligned resources, whether through an online search engine or across independently operated, affiliated content repositories.

Table 1.3 lists a sample of the types of organizations and initiatives under each of the three categories, as well as the initiative's origin or background. While many of the organizations and initiatives listed are quite technical, it is important to keep in mind that they drive ease of use and, in so doing, are a key part of institutionalization.

Table 1.3 Institutionalizing Data and Overcoming Interoperability Challenges

Organization/initiative	*Description*	*Origin*
Consistent Data Definitions: Initiatives that focus on providing a common language or vocabulary and structure that are a precursor to the seamless sharing of data among different systems and applications.		
Assessment Interoperability Framework (AIF)	Provides a common structure to allow for the transfer of any data associated with assessment systems, including student and teacher information, learning standards, assessment items, results, and related data across systems.	AIF grew out of a partnership between the Access 4 Learning Community and the IMS Global Learning Consortium, established to support the U.S. Department of Education's RTTA Program.
Common Education Data Standards (CEDS)	Provides a common vocabulary and reference structure through a data dictionary and logical data model for information that needs to be shared across education organizations.	CEDS was established by NCES.
P-20W Education Standards Council (PESC)	Consists of numerous standards for sharing specific types of education data, such as financial aid, transcript, and admissions information.	PESC is funded almost entirely by membership dues.
Sharing of Information across Systems: Initiatives that provide rules for allowing data to move between and among applications without the data first having to be transformed in some way.		
Digital Passport	A tool that brokers the exchange of student data between states or districts to enable electronic record transfer as students move from one school to another.	Digital Passport is a product of nonprofit organization Common Sense.

table continues next page

Table 1.3 Institutionalizing Data and Overcoming Interoperability Challenges *(continued)*

Organization/initiative	*Description*	*Origin*
Ed-Fi technology	A data model combined with a tool suite that streamlines the sharing of student data and provides dashboard elements for use by educators to improve the academic outcomes of students.	Ed-Fi technology was developed by the Ed-Fi Alliance with funding from the Michael & Susan Dell Foundation. Today the Ed-Fi Alliance owns and issues licenses for Ed-Fi technology.
MyData	Provides functionality within any system containing student data and allows students (or their families) to export their data in an open format to maintain a copy of their own education records.	MyData is an initiative of the U.S. Department of Education.
Search, Alignment, Discovery of Education Resources: Initiatives intended to optimize the process of finding appropriate resources, including standards-aligned resources.		
Learning Resource Metadata Initiative (LRMI)	An education metadata project developed to improve discoverability and delivery of learning resources.	LRMI was initially funded by the Bill & Melinda Gates Foundation and the William and Flora Hewlett Foundation. It was established by the Association of Educational Publishers and Creative Commons and has since been transferred to the Dublin Core Metadata Initiative (DCMI).
Learning Registry	An open repository of metadata and paradata about digital-learning resources across the Internet, including location and information about alignment to learning standards.	The Learning Registry is a joint effort of the Department of Education and the Department of Defense, with support of the White House and numerous federal agencies, nonprofit organizations, international organizations, and private companies.

Source: State Educational Technology Directors Association 2013.

Prioritizing Professional Development

Professional development opportunities for data system staff vary between state and local levels and across counties. At the state level, opportunities exist for staff to attend and participate in conferences, as well as to pursue additional training opportunities. Additionally, Maryland has Teacher Professional Development Standards,[12] which are intended to guide efforts to improve professional development for all teachers. They are derived from the National Staff Development Council's Standards for Staff Development. Standard 7 is titled "Data-driven" and states that effective teacher professional development relies on rigorous analysis of data. Indicators for this standard include the following (MSDE 2014b):

- Access to high-quality student data from various sources, organized in user-friendly formats
- Knowledge and skills necessary to use disaggregated student data for planning, implementation, and evaluation of professional development and instructional programs

- Time provided to teachers and others to examine student data as the starting point for planning professional development
- Analysis of disaggregated student data to identify gaps between student learning and standards for proficiency, and inform the choice of content for professional development and
- As appropriate to school and district needs, data analysis focused on results from approved national, state, and local assessments; student work samples and portfolios; and behavioral indicators such as attendance and disciplinary referrals.

Professional development for data system staff at the local level depends on team size and budget availability. Counties are resourceful, often designing programs with limited resources. For example, when Harford County implemented a new data management system, the county worked with the Teachers Association and used a "train the trainer" model to effectively reach the necessary school staff (box 1.1). Harford worked with the vendor, Performance Matters, to build an integrated system for recording, tracking, and reporting student information and student assessment data. To train teachers on how to use the new system, the county provided the option of an online Moodle Course or an in-person training, based on teacher preference. The training lasted six to eight hours and finished with a quiz and an option to retake the quiz if necessary. The county also trained roughly 55 Technology Liaisons: full-time teachers equipped to provide technology support. Chris Wilkinson, former Instructional Data Specialist with Harford County's Curriculum, Instruction, and Assessment Department, said the technology support provided by the liaisons was a critical driver of successful user adoption. In addition to the liaisons, users could tap other resources to learn how to navigate the new system. These included professional development materials, such as brochures, as well as simple step-by-step directions (figure 1.3), and

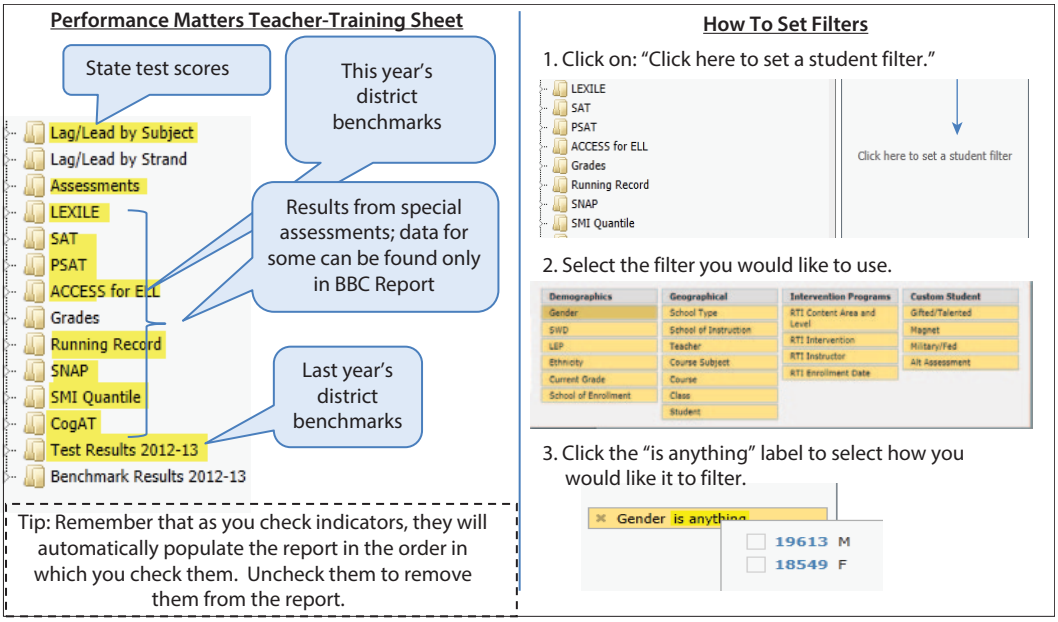
Box 1.1 Train the Trainer Model Scales EMIS across Schools

Training a group of trainers who then take EMIS skills back to their schools is an efficient way to scale EMIS training. In Harford County, teachers were trained to work as Technology Liaisons in their respective schools, and were also supported by a suite of learning tools. Harford's EMIS training checklist includes:

- Highly interactive and visual courses to make the learning experience informative and fun
- Motivate participants with engaging material and certificates upon completion
- Flexible learning options, including either online Moodle courses or in-person training
- Ongoing and easy to use support, such as one- to two-minute video lessons and short pamphlets, which recognize the busy schedules of teachers and need to find answers fast

Source: Harford County staff in interview with authors 2014.

Figure 1.3 Harford County: Examples of Rapid Teacher-Training Documents



Source: Harford County staff 2014.

automated help buttons in the system. Wilkinson said that instead of a lengthy manual, the county provided a series of one-page training sheets to tailor information to teachers' busy schedules.

> "Looking at data as a tool to inform teaching was a new skill for many of our teachers," Wilkinson said. "They generally looked at it as a result, but simple professional development tools customized to their needs helped them to see data as a tool to better themselves as teachers." (Interview with Authors 2014).

Reaching a Data-Driven Culture

Maryland's data-driven culture is part of a national trend. Over the last decade across the United States, the importance of data has grown, and data utilization has gained momentum. One driver is the concept of "open data," which refers to data and content that can be freely used, modified, and shared by anyone for any purpose (Open Knowledge n.d.). According to *Government Technology* (2014), 39 states and 46 localities provide data sets to data.gov, the federal government's online open-data repository, and 30 jurisdictions, including the federal government, have taken additional steps to institutionalize practices in formal open-data policies.

The private and social sectors are also seasoned supporters of this trend. The DQC highlights how the social sector can play a key role in promoting effective utilization of education data. Its efforts fall into three main categories: (1) leading efforts to build consensus and collaboration for the effective use of data to

improve education outcomes, (2) building knowledge and creating evidence-based recommendations and resources for the field, and (3) advocating for, and supporting, changes in policy and practice to ensure that data effectively and securely follow and serve the individual. The Sunlight Foundation, a national, nonpartisan, nonprofit organization, uses the tools of civic tech, open data, policy analysis, and journalism to make government and politics more accountable and transparent. It maintains an open data map[13] that tracks policies at the state and local levels, as well as best-practice resources (map 1.1).

Maryland's enabling environment is supported by a strong data-driven culture that prioritizes data as a fundamental element of operations and decision making. One tool that promote data-driven culture is MDK12.org[14] (figure 1.4). The site seeks to help schools analyze their state assessment data and to guide them in

Map 1.1 Open Data Map Tracks Relevant Policies

Source: Sunlight Foundation, http://sunlightfoundation.com/policy/opendatamap/.

Figure 1.4 MDK12 Homepage

Source: mdk12.msde.maryland.gov.

making data-driven instructional decisions aimed at supporting improved performance for students. Educators across Maryland have contributed to content and resources on the site.

Specifically, the site was designed to serve as a practical tool usable by a variety of stakeholders to assist in understanding, analyzing, and making use of student achievement data (MSDE 2014c). According to the MSDE, feedback from principals and teachers suggests that many of them have found the website useful in improving student performance.

The site includes a *Toolkit*[15] to promote a data-driven culture, consisting of presentations, background materials, and assessment tools that help schools use data to reach their goals. The site also provides various user guides for different stakeholder segments and data analysis tutorials on a variety of topics. Tutorials offered include

- How the School Progress Index Is Calculated
- How MSDE Calculates Graduation Rate
- How Dropout Rates Are Calculated.

MDK12 received initial funding through a research grant from the U.S. Department of Education's Office of Educational Research and Improvement, later replaced by the Institute of Education Sciences. When the grant expired, the MSDE adopted the project, expanding its objectives. The Department's ability to maintain the initiative is a positive outcome. However, such initiatives may have even more impact if launched under the umbrella of the Department and as part of its website. Not only would this make it easier for stakeholders to find the site, but it also would also demonstrate alignment with the larger, Department education strategy.

Notes

1. Improving Basic Programs Operated by Local Education Agencies: https://www2.ed.gov/policy/elsec/leg/esea02/pg2.html#sec1111
2. Title 13A: http://www.dsd.state.md.us/comar/subtitle_chapters/13A_Chapters.aspx
3. Division of Curriculum, Assessment and Accountability: http://www.marylandpublicschools.org/msde/divisions/planningresultstest/
4. The Maryland Student Records System Manual: http://www.marylandpublicschools.org/MSDE/newsroom/publications/docs/MDStudentRecordsSystemManual2016.pdf
5. StateStat: http://gopi.maryland.gov/
6. 10 Actions to Ensure Effective Data Use: http://dataqualitycampaign.org/your-states-progress/by-state/overview/
7. Family Educational Rights and Privacy Act: https://www2.ed.gov/policy/gen/guid/fpco/ferpa/index.html
8. Children's Online Privacy Protection Act: http://www.coppa.org/coppa.htm

9. Maryland State Department of Education: http://www.marylandpublicschools.org/MSDE/aboutmsde/PrivacyStatement.htm?WBCMODE=PresentationUnp%25%253e%25%253e%25%3E%25%25%3E%25%3E
10. Maryland Report Card: http://msp.msde.state.md.us/introduction/privacy.aspx?K=99AAAA
11. International Standard Classification of Education (ISCED): http://www.uis.unesco.org/Education/Pages/international-standard-classification-of-education.aspx
12. Teacher Professional Development Standards: http://mdk12.msde.maryland.gov/instruction/professional_development/teachers_standards.html
13. Open data map: https://sunlightfoundation.com/policy/opendatamap/
14. MDK12.org: http://mdk12.msde.maryland.gov/interact/index.html
15. Toolkit: http://mdk12.msde.maryland.gov/process/cfip/Meeting_k.html

CHAPTER 2

Aligning the Pieces to Deliver Value

Across Maryland, each county has an established education information system, though the systems vary widely in terms of design and degree of advancement. Each county also has an education data warehouse (EDW). Some counties built their data systems in-house, while others purchased theirs off the shelf. The state-level data system was built in-house and comprises three main systems: (1) the Education Data Warehouse (EDW), (2) the Longitudinal Data System (LDS), and (3) the Web Data Collection System (WDCS). The EDW incorporates both administrative and learning-outcomes data. Established in 2010, the LDS integrates K-12 data with higher education and workforce data. It receives additional flat file transfers for early childhood, career and technology education, and special education data. The system's infrastructure is established, though all data have not yet been fully loaded. While the MSDE tries to establish clear data-sharing processes, some counties report that at times it makes changes to data requirements, requests data outside of designated times with short notice, or requests data that have already been collected, indicating gaps in coordination and communication. The lack of fully integrated financial and human resources data at county and state levels creates data silos, limiting comprehensive functionality by the data system.

Data Coverage and Integration Are Key

A comprehensive education data system should include administrative data, financial data, human resources data, and learning-outcomes data (table 2.1). This information should be available at both the individual and aggregate level. The type of data entered into the system needs to follow logic and fixed methodology and have a well-defined purpose (Abdul-Hamid 2014).

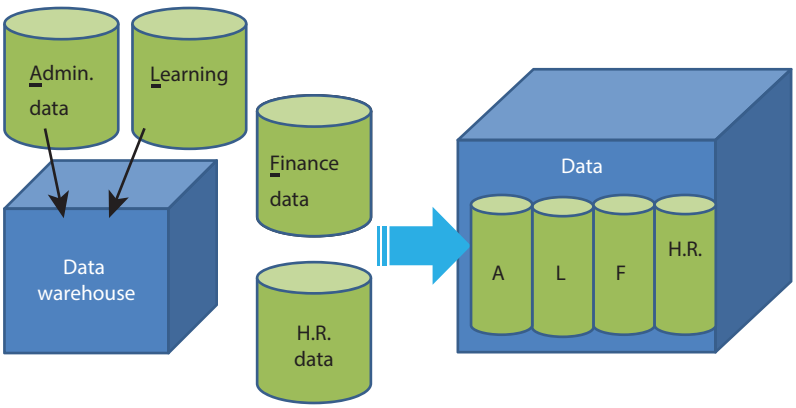
Further, data stored in integrated—as opposed to siloed—systems provide more opportunities for advanced analytics, ultimately enabling greater insight into an education system (figure 2.1). Currently Maryland is transitioning from a siloed system into a more-integrated one. Likewise, many of its county systems are also pursuing greater integration of data.

Table 2.1 Data Coverage: Best Practice and Maryland

Type	*Best practice*	*Maryland*
Administrative data	• Demographic • Health • Student progression (enrollment, repeat, dropout, etc.) • School-level data	• Demographic • Health • Progression • School-level data
Financial data	• Budgets and revenues • Spending • Subsidies • Cost per student	• Some budgets and revenues • Cost per student
Human resources data	• General demographics • Salaries • Performance evaluation • Professional development	• Some general demographics • Some performance evaluation
Learning outcomes data	• Classroom assessments • National assessments • International assessments	• National and state assessments • International assessments

Source: Adapted from Abdul-Hamid 2014.

Figure 2.1 Moving toward an Integrated Approach



Source: Adapted from Abdul-Hamid 2014.

Maryland's state-level data system was built in-house using an Oracle platform. In addition to the three main systems discussed above, it also includes a Report Card Data Mart. Established in 1999, the Data Mart is the hub for statewide K-12 education data, including staff and school information.

The hub captures the following student information: attendance, enrollment, dropouts, retention and progression, student discipline, High School Assessment (HSA) data, Maryland School Assessment (MSA) data, and national standardized assessment data (SAT, A.P., ACT). It also records graduation rates, special

education information, high school completion, and grade 12 documented decisions. Staff assignments, certifications, and Highly Qualified Teachers are also recorded in the EDW, though staff salaries are not included. Additional databases that do not integrate with the EDW include the Employee Information System; Early Childhood, Career and Technology Education Access; and the Special Education Database. The Report Card Data Mart disseminates information annually via the Maryland Report Card.

The Warehouse system is a distributed, multitier system, with several Oracle databases hosted in a multiserver Dell environment. Educational data are inserted into the Oracle databases via Informatica ELT programs. Reports and data analysis are performed using COGNOS C8 BI, SAS 10, and OBIEE 11g (MSDE 2013–14). All systems are defined based on a wireframe that illustrates integration capabilities and movement of data (figure 2.2).

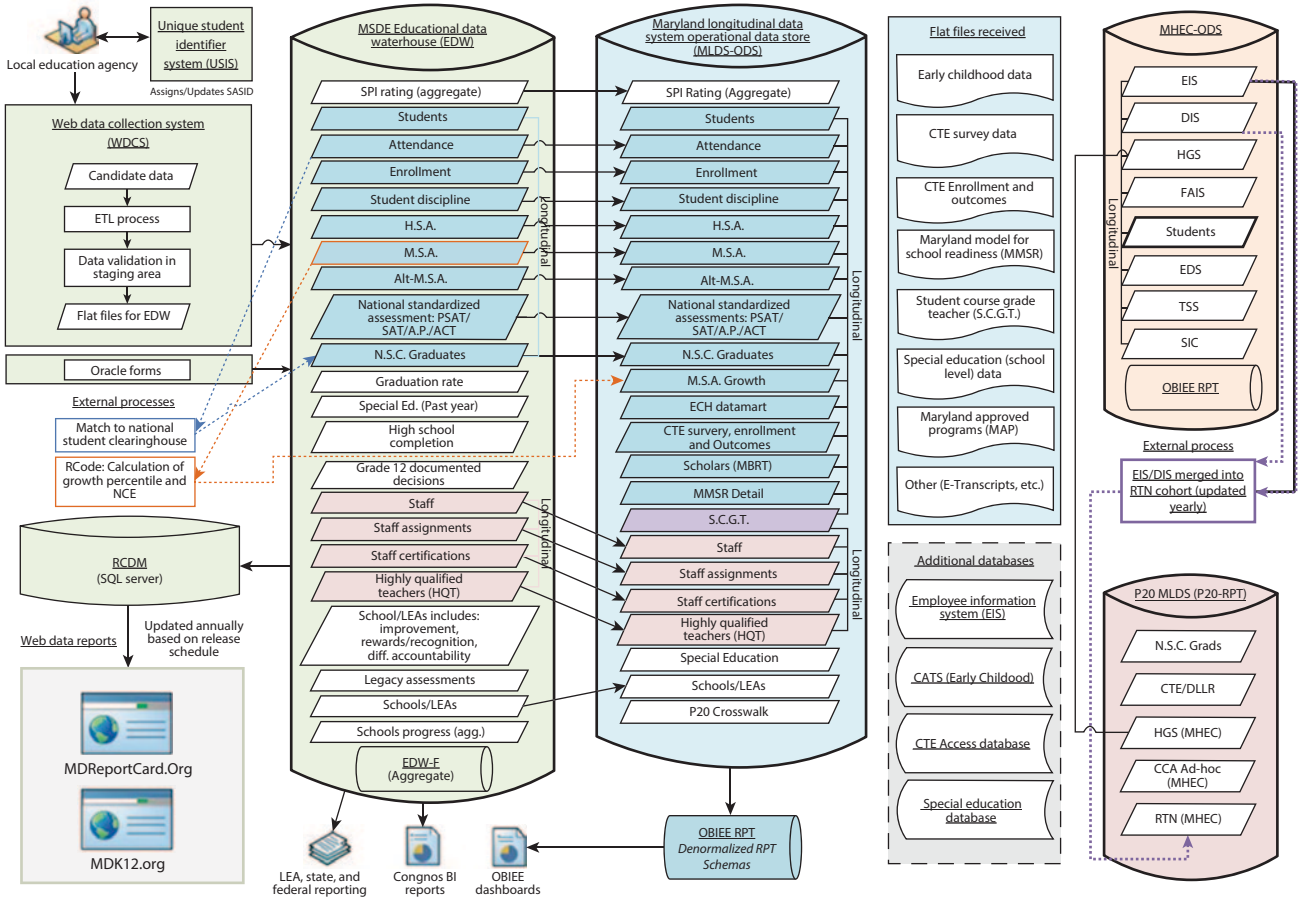
Streamlining a Highly Decentralized Education System

Information systems have a variety of points at which users can access data. Highly centralized data systems have fewer access points. Under a centralized data system, a single department or unit, usually housed within the central government, receives data and controls the data management, use, and dissemination. A decentralized data system offers the potential to access data at multiple points across the education system. Figure 2.3 illustrates an example of each type of data system. With the centralized data system, data flow from schools to regional education offices to state-level education offices and finally arrive at the central government. Users are unable to access education data unless they make a request to the central government, or the central government disseminates information. With a decentralized model, users can access data at multiple points, depending on how the network architecture is established.

Network architecture refers to the combination of hardware, software, connectivity, communication protocols, and mode of transmission used to enable communication across a network of users. One common network architecture is the client/server model in which each computer or process on the network falls into the category of client or server. Servers are powerful computers or processes dedicated to managing disk drives (file servers), printers (print servers), or network traffic (network servers). Clients are PCs (personal computers) or workstations on which users run applications. Clients rely on servers for resources, such as files, devices, and even processing power. Client/server architecture is common among centralized data systems. In such cases, access to data and applications is limited to those who are directly connected to the servers at the central government. Local, regional, and state education offices depend on the central government for information and reporting needs.

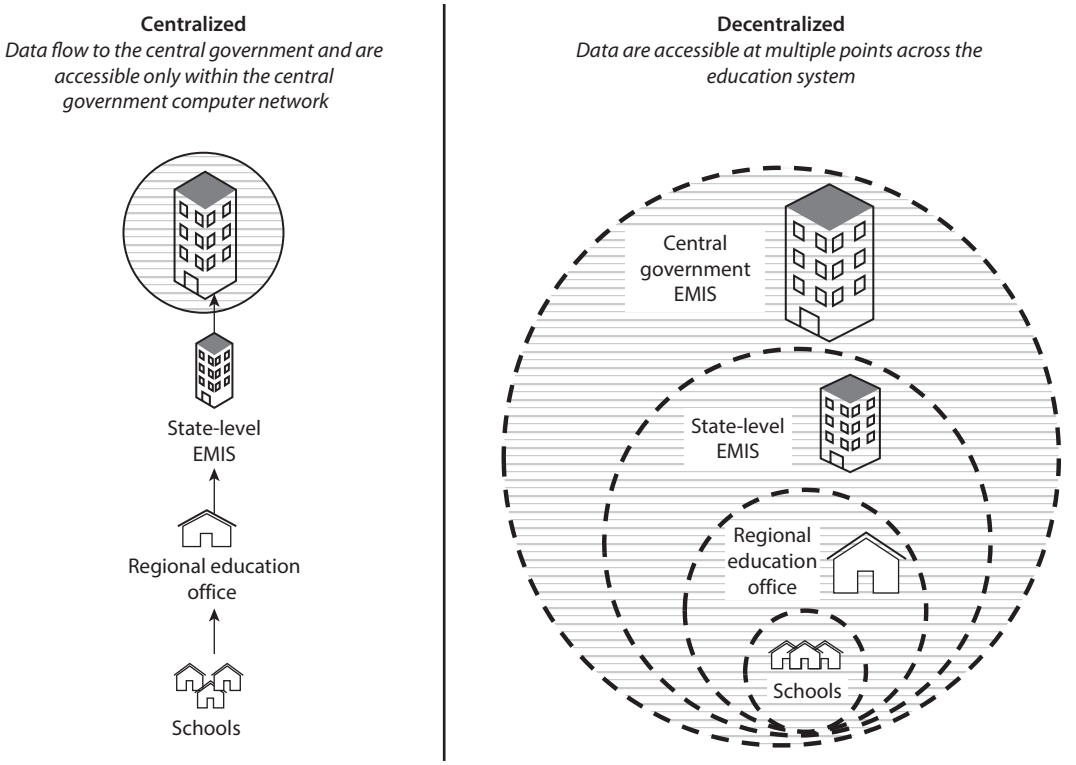
The state of Maryland has a highly decentralized structure, with information systems at school, county, and state levels. To ensure that data effectively flow

Figure 2.2 MSDE EMIS Wireframe



Source: MSDE 2014b.

Figure 2.3 Centralized and Decentralized EMIS



Source: Howard County staff 2015.

from system to system, Maryland has a variety of protocols and processes around information sharing. In the Maryland Education Management Information System assessment (World Bank 2015), all of the counties examined had a central data warehouse or database that integrates with administrative data and learning-outcomes data. This structure is critical for compliance purposes. Schools are provided with access points to access the county's information system.

At the county level, there is minimal integration of administrative and learning-outcomes data with financial and human resources data. Some of the county systems incorporate some human resources data, such as teacher evaluations; however, extended human resources data are generally captured in other systems. Likewise, some financial data are captured in these systems, but extended data, especially on salaries or professional development expenses, are captured outside of the education data system. Of the seven counties examined during the assessment of such systems in Maryland, none had the same data system structure, and all were in different stages of upgrade (table 2.2).

Table 2.2 Sample of Different Systems Used across Counties

County	*Data warehouse*	*Student information*	*Additional programs Integrated*	*Additional programs Not integrated*
Anne Arundel County	PowerSchool	Performance Matters, Schools administrative student information	TIENET (special needs), Achievement Series, TOADS	DIBELS, Fountas, and Pinnell
Cecil County	Pearson Inform	iTracker	PowerSchool	DIBELS, AppliTrack
Charles County	Data Warehouse using Amazon Web Services	iSeries connects to Edline and Gradebook, now Blackboard products	TEAMS by Insystech	DIBELS, Rigby PM Books, AppliTrack, Substitute Employee Management System
Harford County	Performance Matters Assessment and Data Management	Performance Matters	Performance Matters	
Howard County	Built with edVantage	Built with Synergy	LMS built with Canvas by Instructure	
Kent County	SchoolNet	PowerSchool		Scholastic Reading and Math Inventory, DIBELS, Dreambox, Conceptua Math
Montgomery County	Built with MicroStrategies	Online Administrative Student Information System	Online Achievement and Reporting System	Substitute Employee Management System, Human Resource Information System, Financial Management System

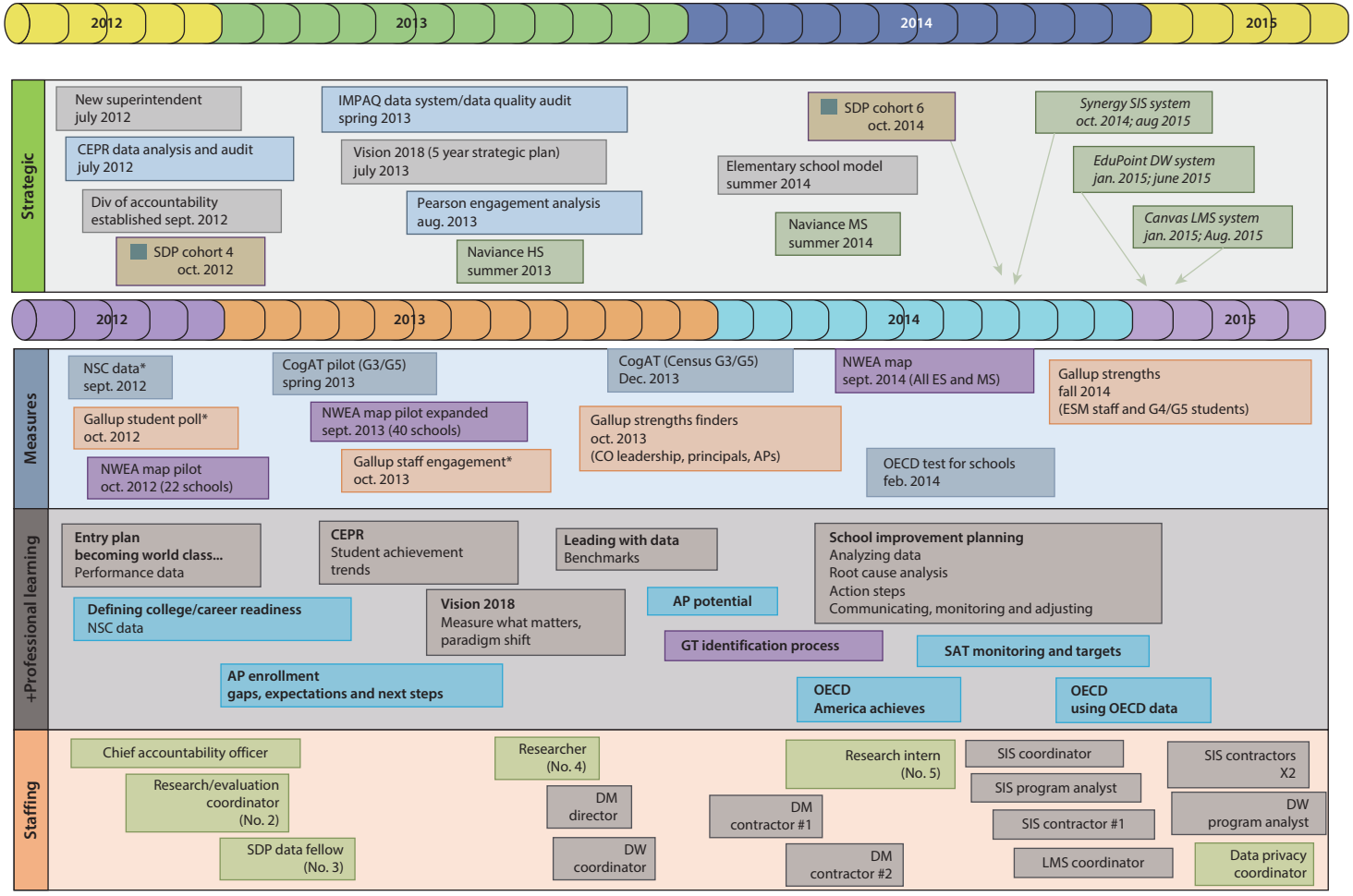
Leadership, Strategy, and a Commitment to Continuous Improvement

Between 2012 and 2015, Maryland's Howard County implemented a cutting-edge education data system. The success of the new system stemmed from the county's ability to develop key enabling conditions for the system, most notably, vision, strategy, and human resources. The process started in 2012, when the county hired a new Superintendent. With the support of the new Superintendent, Howard County created the Office of Accountability and hired a Chief Accountability Officer to steer the process of identifying and implementing an effective data system and a strong accountability strategy.

The Chief Accountability Officer and her team conducted an extensive assessment involving internal dialogue and focus groups, as well as several external audits conducted by the Center for Education Policy Research at Harvard University, IMPAQ International, and Pearson.

They determined that existing data systems did not provide adequate data to support the county's strategic plan. The team needed multiple data points to effectively inform decision making, and it needed data to actively monitor progress toward goals. Constructing a system that could integrate these data and make the data readily available and easy to analyze was key. Guided by a strategic timeline (figure 2.4), Howard County made the decision to build

Figure 2.4 A Thoughtful Strategic Plan in the Road Map for an Effective EMIS



Source: Howard County staff 2015.

a comprehensive, integrated system including a student information system, a learning management system, and a data warehouse.

The cost structures for each system were negotiated and ultimately fell within budget requirements (table 2.3). According to Howard County, the budget for the integrated system totaled $5.8 million (spent over five years), which is just under 1 percent of the FY 2015 Howard County Public School System operating budget of $758.8 million.

The student information system is a comprehensive, web-based system that includes data on student demographics, enrollment, registration, scheduling, attendance, grading, discipline, and transcripts, as well as a master-schedule builder. It equips teachers, administrators, and parents with the ability to obtain up-to-the-minute access to student information.

The learning management system is a cloud-based learning platform that teachers, students, and parents can access on any device at any time. It integrates with the student information system to seamlessly populate class information and pass along critical student data.

The data warehouse is a centralized repository of data that empowers administrators, principals, and school staff with timely and accurate longitudinal data to inform instructional practices and student performance. Reflecting on the implementation of the integrated data system, Howard County identified key advantages that the new system introduced, as well as implementation challenges (table 2.4).

A key outcome in addition to the advantages in table 2.4 is that the new system provides a meaningful foundation for data-driven target setting. Before the integrated system was established, performance management targets were not aligned to the overarching strategy, nor were they consistently tracking and facilitating growth (Hitch and Fullerton 2013). Howard County also provided a list of what it identified as key success factors. These are the essential elements that made implementation possible and helped overcome obstacles:

- Leadership support and vision
- Funding
- Parallel approach to project implementation
- Skilled technical staff
- Project timeline and milestones
- Monitoring (daily, weekly)
- Communication within the Division and with the vendor
- Collaboration, internally, and externally
- Detailed training plan
- Management and understanding of the functional details (specifications) of systems
- Ability to influence change in culture
- Campaign to equip staff with the right tools and technology
- Flexibility.

Table 2.3 System Cost per Student

System	*Cost per student*
Student Information System	$9.33
Learning Management System	$2.68
Data warehouse	$7.62

Source: Howard County staff 2015.

Table 2.4 Howard County Reflections on Implementation of Integrated EMIS

Advantages	*Challenges*
• Ability to obtain accurate, real-time data • Single point of entry • Longitudinal analysis • Predictive analysis • Promotes equity	• Communication outside division • Aggressive timeline for implementation • Training of 8,000+ staff on three products • End-user buy-in

Source: Howard County staff 2015.

The Future of Data Systems: Linking Data from K-12 to Workforce

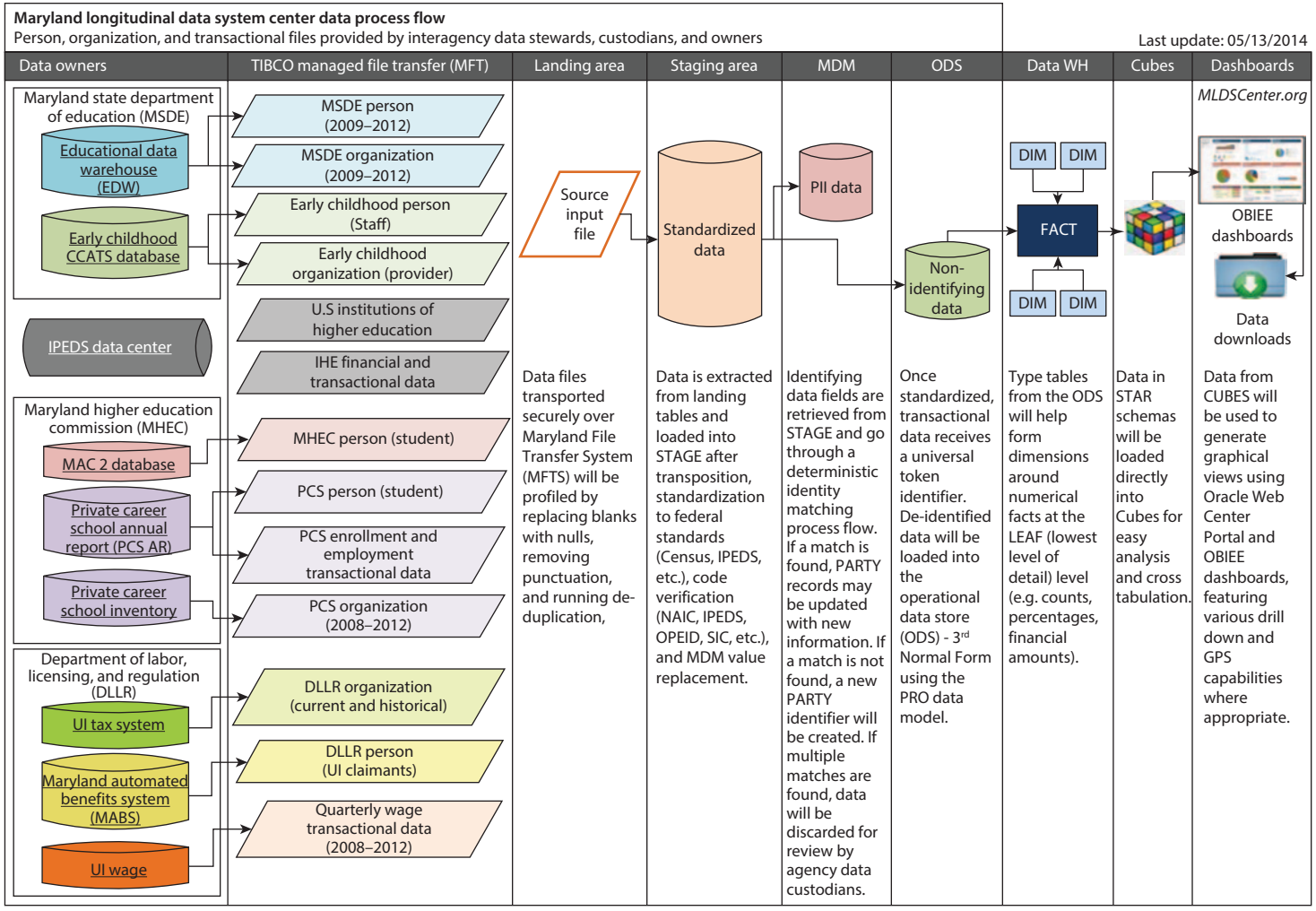
The Maryland Longitudinal Data System (MLDS) is a statewide data system that aims to integrate individual-level student data and workforce data with the goal of informing decision making and ultimately, improving the State's education system. The data system is complex, consisting of multiple data owners, interagency data stewards, robust data architecture, and a myriad of data security, quality, and analytical tools and processes (figure 2.5).

The Maryland Longitudinal Data System Center[1] is the agency responsible for overseeing and maintaining the system. It has a mandate to organize, manage, disaggregate, and analyze individual student data; and to examine student progress and outcomes over time, including preparation for postsecondary education and the workforce. The Center has a clearly defined set of responsibilities, which include the following (Maryland Longitudinal Data System Center 2015):

- Serving as a central repository of student and workforce data
- Ensuring compliance with the federal Family Educational Rights and Privacy Act (FERPA) and other relevant privacy laws and policies
- Designing, implementing, and maintaining strict system-security procedures
- Conducting research pursuant to the Governing Board's research agenda
- Maintaining a public website and data portals and
- Responding to public information requests.

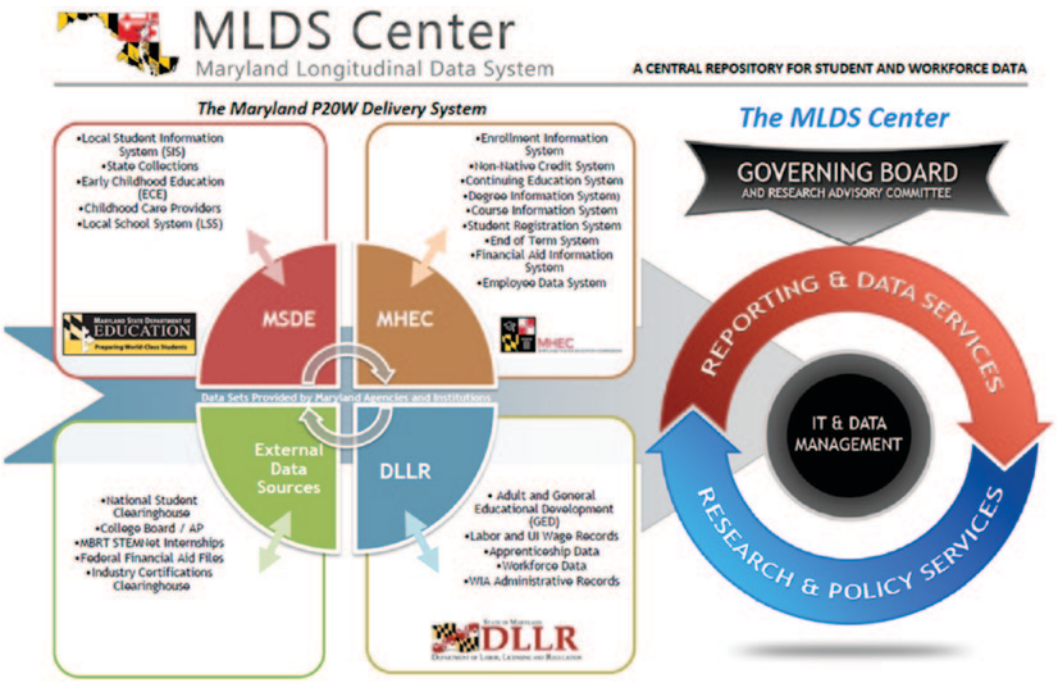
To fulfill these responsibilities, the Center works in partnership with the Maryland Higher Education Commission (MHEC);[2] the MSDE; the Maryland Department of Labor, Licensing and Regulation (DLLR);[3] and the University of Maryland School of Social Work[4] and College of Education[5] (figure 2.6).

Figure 2.5 Maryland Longitudinal Data System Center, Data Process Flow



Source: Maryland Longitudinal Data System Center 2014.

Figure 2.6 Maryland Longitudinal Data System



Source: Maryland Longitudinal Data System Center 2014.

In 2010 then Governor O'Malley passed Senate Bill 275, Chapter 190, which established the MLDS. The Bill authorized the MLDS Governing Board to oversee the project and mandated that the Governing Board comprise high-level officials from across the participating agencies. This leadership support and collaboration was an essential element to the success of the project. As part of the design phase, the Governing Board identified 15 key policy questions that each participating agency needed answered. From there, it worked backwards to build a system capable of answering these key guiding questions:

Postsecondary Readiness and Access

1. Are students academically prepared to enter postsecondary institutions and complete programs in a timely manner?
2. What percentage of high school exiters go on to enroll in postsecondary education?
3. What percentage of high school exiters entering college are assessed to need to take developmental courses, in what content areas?
4. Which financial aid programs are most effective in improving access and success for students?

Postsecondary Completion

5. How likely are students placed in developmental courses to persist in postsecondary education and transfer and/or graduate?
6. Are community college students able to transfer within the state to four-year institutions successfully and without loss of credit?
7. What are the differences in performance, retention and graduation, including time to degree, of students across various postsecondary programs?
8. What are the characteristics of two-year institutions that are allowing students to persist most effectively and either graduate or transfer?
9. Which four-year institutions are graduating students most effectively and in the most timely manner?

Workforce Outcomes

10. What happens to students who start at community colleges and do not go on to four-year institutions?
11. What are the educational and labor market outcomes for individuals who use federal and state resources to obtain training at community colleges or other postsecondary institutions?
12. What economic value do noncredit community college credentials have in the workplace?
13. Are college graduates successful in the workforce?
14. What are the workforce outcomes for students who earn a high school diploma but do not transition to postsecondary education?
15. What are the workforce outcomes of Maryland high school noncompleters?

The Governing Board also has oversight of the MLDS Center research agenda,[6] which is guided by the 15 policy questions. The research agenda also has basic guidelines; for example, all research analyses and research reports intended to inform policy and programming are required to utilize data from at least two of the three partner agencies (MSDE, MHEC, DLLR).

The foundation of the LDS is established, including consensus across stakeholders, governance structures, management, and infrastructure. However, the system is not yet fully populated with data or fully operational. The last data inventory showed that most data from participating entities have been approved, though remaining in various stages of preparation and loading into the system (Maryland State Longitudinal Data System Center 2014). Fully loaded and utilized data in the MLDS will mark a major milestone for Maryland's education system as a whole.

Maryland's process of establishing the foundation and infrastructure for the LDS can guide other institutions. In general, such systems do not need to be extremely robust. They simple need

- An identifier system
- Common code sets that track information over time and
- Systems and processes to keep data secure.

In addition to these technical elements, other key ingredients include ongoing participation and support from high-level decision makers and thorough consensus-building and communication efforts across stakeholder groups.

The MLDS is part of a national movement for states to implement such systems. In 2005, as part of the Educational Technical Assistance Act of 2002, the Statewide Longitudinal Data Systems (SLDS) Grant Program[7] started awarding grants and technical assistance to states, with the aim of catalyzing the successful design, development, implementation, and expansion of K-12 and P-20W (data from early learning to workforce) LDSs. Additional national efforts supported this movement. These include the Common Education Data Standards (CEDS) project,[8] a national collaborative effort to develop voluntary, common data standards for a key set of education data elements, with a goal of streamlining the exchange, comparison, and understanding of data within and across P-20W institutions and sectors.

The DQC also supports this effort by tracking the progress of states toward achieving 10 Essential Elements of statewide LDSs[9] and the 10 State Actions to Ensure Effective Data Use.[10] In 2014 Maryland scored 10 out of 10 Essential Elements and eight out of 10 State Actions. The two-point loss for the latter was a result of the lack of a fully operational and utilized LDS. DQC's State Actions assessment consists of 24 questions. Maryland answered "Yes" to all but three (appendix C):

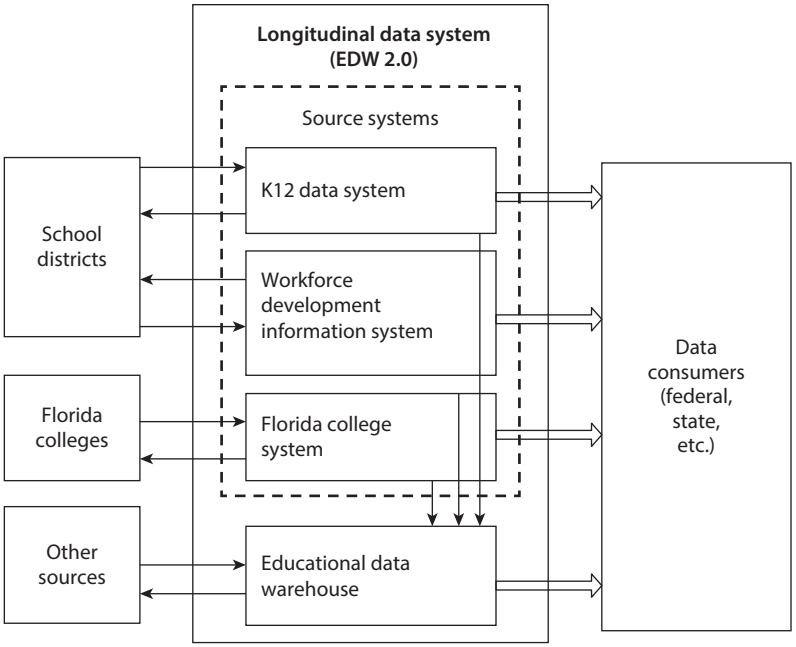
- Do parents, teachers, and appropriate stakeholders have access to student-level longitudinal data?
- Does state policy ensure that teachers and parents have access to their students' longitudinal data?
- Are teachers and principals trained to use longitudinal data to tailor instruction and inform schoolwide policies and practices?

Answering yes to these questions point to the existence of a complete and fully operational and utilized data system. As described above, Maryland has established a sound infrastructure for the system, but has yet to reach a level of complete implementation.

The state of Florida in the United States provides an example of a fully operational and utilized LDS (figure 2.7). In spite of a turbulent start due to political restructuring, Florida's statewide LDS helped to institutionalize an EDW in the education system, while cultivating a data-driven culture. State educational accountability policies date back nearly 50 years, positioning Florida at the forefront of efforts to track and learn from education data.

The Florida Department of Education serves nearly 2.7 million students, 4,200 public schools, 28 colleges, 192,000 teachers, 47,000 college professors and administrators, and 321,000 full-time staff throughout the state. It has the oldest LDS in the country, dating back to 1995. Florida's Statewide Longitudinal Data System tracks 2.7 million students across multiple

Figure 2.7 Florida Longitudinal Data System



Source: Adapted from Florida Department of Education 2012.

agencies via a centralized data warehouse. Utilization examples include (Data Quality Campaign 2013) the following:

- Accountability and reporting across the education system
- Reporting almost immediately after the two- to three-week submission period
- District-provided files containing data on students who are included in calculations for accountability purposes by the state
- High use of data by teachers and administrators
- Collaboration between Florida's Education Department and legislative staff to ensure or strengthen understanding of the data used by legislators
- Use of student-level data by Florida Office of Program Policy Analysis and Government Accountability to examine performance in various areas in the context of costs of education.

While Florida was certainly a pioneer in LDSs, its centralized data warehouse architecture was set up in 2003. More than a decade later, it was ready for upgrades and enhancements. Florida pursued funding for upgrades from the same federal grant that Maryland used (ARRA/RTTT, ESRA/SLDS). Several key upgrades by Florida (McQuiggan and Sapp 2014a, 2014b) include the following:

- Improvement of data quality through a feedback loop that reports data-quality issues back to the agencies where the issues originated.

- A more efficient unique-identifier (UID) system that uses a common, statewide UID, rather than a local UID, which has a cumbersome and inefficient process for tracking student movement.
- An improved process for researcher access to data, with greater automation and use of advanced data storage including data marts and cubes, as well as business intelligence. Previously Florida had good open data policies for researchers, but the initial process to provide researchers with access to data was highly manual and time-consuming.
- Organization of a data governance board, which, surprisingly, was not established with the initial system. In retrospect, this governing body would have benefited the state, especially in the management of metadata.

These upgrades also reveal lessons learned. An additional key lesson from Florida is the importance of establishing funding mechanisms that will maintain the system after the initial federal grants expire. Commitments from state legislatures, in the form of either matching grants or ongoing funding, can ensure the long-term viability of the system (McQuiggan and Sapp 2014a, 2014b).

Unique Identifiers Amplify Data System Capabilities

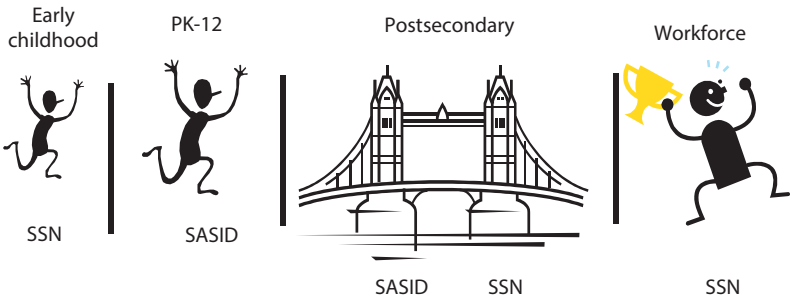
All Maryland public school students are assigned a State-Assigned Student Identifier (SASID), a unique number that remains with a student throughout his or her career in Maryland public schools. The SASID enables Maryland to track students as they move from grade to grade and across campuses or districts within the state. It also enables the MSDE to longitudinally track student performance.

The Department generates and assigns identifier numbers through the Unique Student Identifier System (USIS). The system has been operational since 2008, and tracks students back to 1986. County education offices are responsible for requesting and maintaining numbers for all students enrolled in their county using the USIS system. They must notify the Department via USIS of any changes to student information and provide required supporting documentation. Updates include changes in student grade or boundary school, or in a student's name. USIS validates all identifier numbers reported to the MSDE (MSDE 2015). The identifiers are archived after students reach the end of the academic year of their 22nd birthday.

The identifier system plays a central role in enabling integration with other systems. It provides a key element in structuring identifiers for the LDS. Identifier numbers continue to serve as an identifier in postsecondary education, along with student Social Security numbers, creating a bridge that allows the LDS to follow the progression of students across all four stages (Early Childhood, PK-12, Postsecondary, to Workforce) (figure 2.8).

Maryland is also participating in efforts to link student learning with teacher inputs; however, the extent of implementation is unclear. The state will participate in Phase II of the Teacher-Student Data Link Project,[11] an initiative that

Figure 2.8 SASID Helps Link to Workforce



Source: Maryland Longitudinal Data System Center 2014.

brings states and school districts together to work on a common approach to linking teachers' inputs and students' learning outcomes. Across the nation, states are looking to use this type of accountability data to boost student learning. In Maryland, the project collection is referred to as the Student Course Grade Teacher collection. On a semiannual basis, the project captures a student and his or her demographics with a teacher and his or her demographics, as well as course and grade (performance) information. With support from federal grants, the architecture and framework for the collection are in place and trainings are underway, though the data do not yet appear to be used in regular practice at county and school levels.

Notes

1. The Maryland Longitudinal Data System Center: http://www.mldscenter.org/
2. MHEC: http://www.mhec.state.md.us/
3. DLLR: http://www.dllr.state.md.us/
4. School of Social Work: http://www.ssw.umaryland.edu/
5. College of Education: http://www.education.umd.edu/
6. MLDS Center research agenda: https://mldscenter.maryland.gov/ResearchAgenda.html
7. Statewide Longitudinal Data Systems (SLDS) Grant Program: https://nces.ed.gov/programs/slds/about_SLDS.asp
8. Common Education Data Standards (CEDS) project: https://ceds.ed.gov/Default.aspx
9. 10 Essential Elements of Statewide Longitudinal Data Systems: http://dataqualitycampaign.org/your-states-progress/10-essential-elements/
10. 10 State Actions to Ensure Effective Data Use: http://dataqualitycampaign.org/your-states-progress/10-state-actions/
11. Teacher-Student Data Link Project: http://www.tsdl.org/

CHAPTER 3

The Path to Quality Data: Building Confidence in Your Data

In Maryland, federal and state policies mandate the collection of quality data, and a variety of systematic processes ensure implementation of these policies. First, "The Maryland Student Records System Manual" documents procedures for maintenance of student data across a decentralized education system. Specifically, it shares requirements and maintenance directions on topics such as data definitions, sample forms, relevant policies, and data-coding requirements. Additional manuals are regularly updated at the state level and circulated to counties, describing processes and requirements for reporting. Examples include the "Attendance Procedures and Web Data Collection System User Manual" and the "High School Assessment Status and Completers Reporting and Procedures Manual." Second, with regard to the flow of data, schools report data to counties through a variety of digital systems unique to each county. Counties then input student data into the EDW by uploading flat text files through the Web Data Collection System (WDCS). The WDCS is a common, data-inputting interface across different county systems. At the state level, a Data Governance Plan supports data flow, guiding responses to data requests, and informing the collection, reporting, and use of data. Third, multiple points of validation exist to ensure accurate reporting. Data are validated first when they are transferred from schools to counties, and again through the WDCS, when the data move from counties to the state-level data warehouse. Finally, regulations restrict access to data to relevant staff, with data-privacy measures strictly enforced at all levels.

Achieving Coordination across the Education System

In Maryland, a strong enabling environment helps to bolster the quality of data. The Code of Maryland Regulations consistently prioritizes and mandates quality data. For example, COMAR 13A.08.02.07[1] states, "To ensure that student records maintained under this title are relevant and accurate, a local school system and educational institution regulated by the State Board of Education shall provide for review and updating of student records." It goes on to detail what

data need to be updated and in what timeframe. Finally, the law includes validation measures, stating, "Each principal of an educational institution shall certify annually in writing to the local superintendent the accuracy of student data maintained in the student records at the educational institution."

To ensure that all schools and counties are following the same processes, the Code mandates use of a guiding manual for student data, referred to as the "Maryland Student Records System Manual." COMAR 13A.08.02.04[2] states that procedures for administration of student records are contained in the manual: "Records shall be kept for individual students in accordance with the regulations of the State Board of Education and the 'Maryland Student Records System Manual'." COMAR 13A.08.02.06[3] references the manual with regard to retention and disposition of data: "Guidelines and standards for the retention and disposition of student records maintained under this title shall be those adopted in the 'Maryland Student Records System Manual'." This is a good example of how policies communicate the importance of securing quality data, while a manual supports implementation of that goal by providing guidance on how to handle the data.

The "Maryland Student Records System Manual" is an essential implementation tool that ensures concise and comprehensive maintenance of student data across a highly decentralized education system. The first manual was produced in 2011, and an updated version was released in 2016.[4] The manual provides directions on procedures and actions that administrators must follow as they track students moving through the school system and provide necessary reports. The forms provided in the manual are designed to incorporate all requirements necessary for a student to earn a Maryland diploma. The manual contains the following (MSDE 2015):

- List of relevant policies
- Delegation of county and school responsibility
- Complete list of all data elements and their descriptions
- Detailed directions on how to update and manage student-record cards
- Detailed directions on how to digitalize student-record cards
- Appropriate coding (definition and instructions) for electronic student-record cards.

Authorities at the state level regularly update a variety of additional manuals and distribute them to local agencies as a means to bridge intent and implementation. Manuals describing processes and requirements for reporting include the "Attendance Procedures and Web Data Collection System User Manual" and the "High School Assessment Status and Completers Reporting and Procedures Manual."

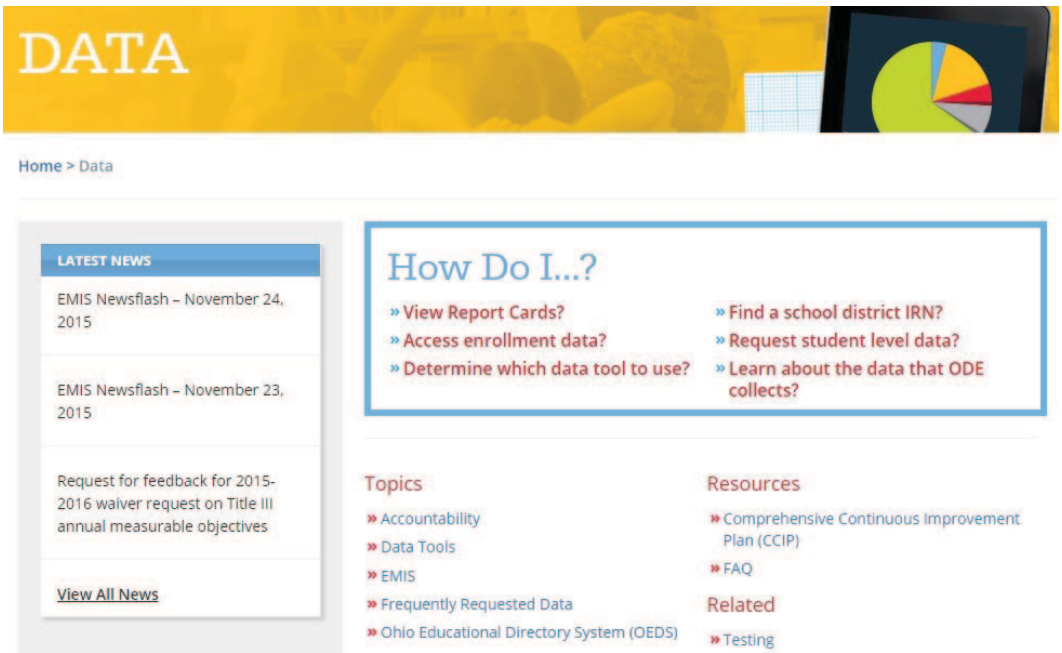
Local authorities input student data into the state-level data warehouse by uploading flat text files through the WDCS. A data collection system that reaches individual schools is an essential part of an advanced data management system. The data collection technology must also be combined with a comprehensive data collection process. In Maryland, the data collection process is driven by reporting schedules that identify deadlines by which specific data must be submitted.

For example, enrollment data must be reported by September 30 of each year. This allows counties to build coded data extraction packages that don't change, which increases efficiency.

While processes exist to guide data reporting and collection, challenges still arise. Some counties said it is difficult to respond to data requests from the Maryland State Department of Education (MSDE) when requirements and file specifications change, or when requests are made outside of the agreed-upon schedule and with short notice. Additionally, some counties said the Department sometimes requests data that it has already received, suggesting a lack of coordination and communication within the Department.

In addition to improving internal processes, the Department could consider strengthening the way it communicates information and updates. The Ohio Department of Education (ODE) provides a good example, with a website that clearly communicates priority information through intuitive user pathways and calls to action. The ODE website features a comprehensive section on "Data" (figure 3.1), and an intuitive user interface. For example, a box titled "How Do I … ?" allows users to search for information on specific subjects, while a column marked "Latest News" shares the most recent data management system newsflashes. These brief write-ups share pertinent information on the ODE Education Management Information System, including data collection, management, and utilization. They provide users with a transparent and easy way to access updates on key deadlines, changes to data requests, important forms, and system upgrades.

Figure 3.1 ODE Provides Intuitive, Easily Accessible Updates on Data and EMIS



Source: ODE: http://education.ohio.gov/Topics/Data.

Under "Topics," a subsection on the data system takes users to an EMIS-specific page that presents a new set of "How Do I … ?" questions, specific to the system. The first question is: "How do I get help with EMIS reporting?" Once again, the site provides the user with an easy-to-use, intuitive set of options.

Knowing Your Data Are Safe and Accurate

Data-validation measures exist at each level of Maryland's education system, including schools and local and state agencies. Each county-level data system has a set of automated validation procedures that check data when the data are entered at the school level. Principals are required to be familiar with the student-records system at his or her school, to provide leadership to staff on its implementation, and to periodically check the system's operations (MSDE 2015). At the county level, the web data-collection system automatically validates data submitted by local authorities. Counties are required to develop and implement procedures to ensure the accurate collection of data and maintenance of records in accordance with the guidelines set forth in the most recent student records system manual.

Network and data security, including privacy, are essential priorities for Maryland, evidenced by policies and comprehensive implementation procedures. The core piece of federal legislation that establishes the foundation for student-data privacy is the Family Educational Rights and Privacy Act (FERPA). This federal law protects the privacy of student education records, and applies to all schools that receive funds under an applicable program of the U.S. Department of Education, essentially covering all public schools. The Act legislates that parents and guardians have rights to children's education data until the student reaches 18 years of age (U.S. Department of Education 2015a). In Maryland, the Code of Maryland Regulations supports compliance with FERPA and adds additional privacy measures around student data.

From an implementation perspective, the "Maryland Student Records System Manual" provides guidance on how schools should manage student records in compliance with FERPA and the Maryland Code. The MSDE follows standard operating procedures and compensating controls designed to protect privacy and security of data, throughout the entire data lifecycle. The launch of the MLDS, which contains personally identifiable information, required specific security enhancements. Security and privacy measures include the following (Maryland Longitudinal Data System Center 2014):

- Separation of data containing personally identifiable information. located in production environment only in separate subnet, VPN, and behind a dedicated firewall
- Restricted access to the production environment, hands-off and fully automated processing by support and development staff
- Use of industry standards such as COBIT 5 to incorporate quality assurance and audit standards into the management process, no personally identifiable information data captured in any logs

- Centralized management of metadata with Oracle Metadata Repository
- Encryption in-flight and at-rest
- Privacy-compliant release of information, only compliant data may be released to ensure that the data system meets the requirements of FERPA, Privacy Act, and other relevant privacy laws and policies
- De-identified data used for analysis and research, aggregation used when releasing data
- Yearly security training
- Federal and state background checks for all employees.

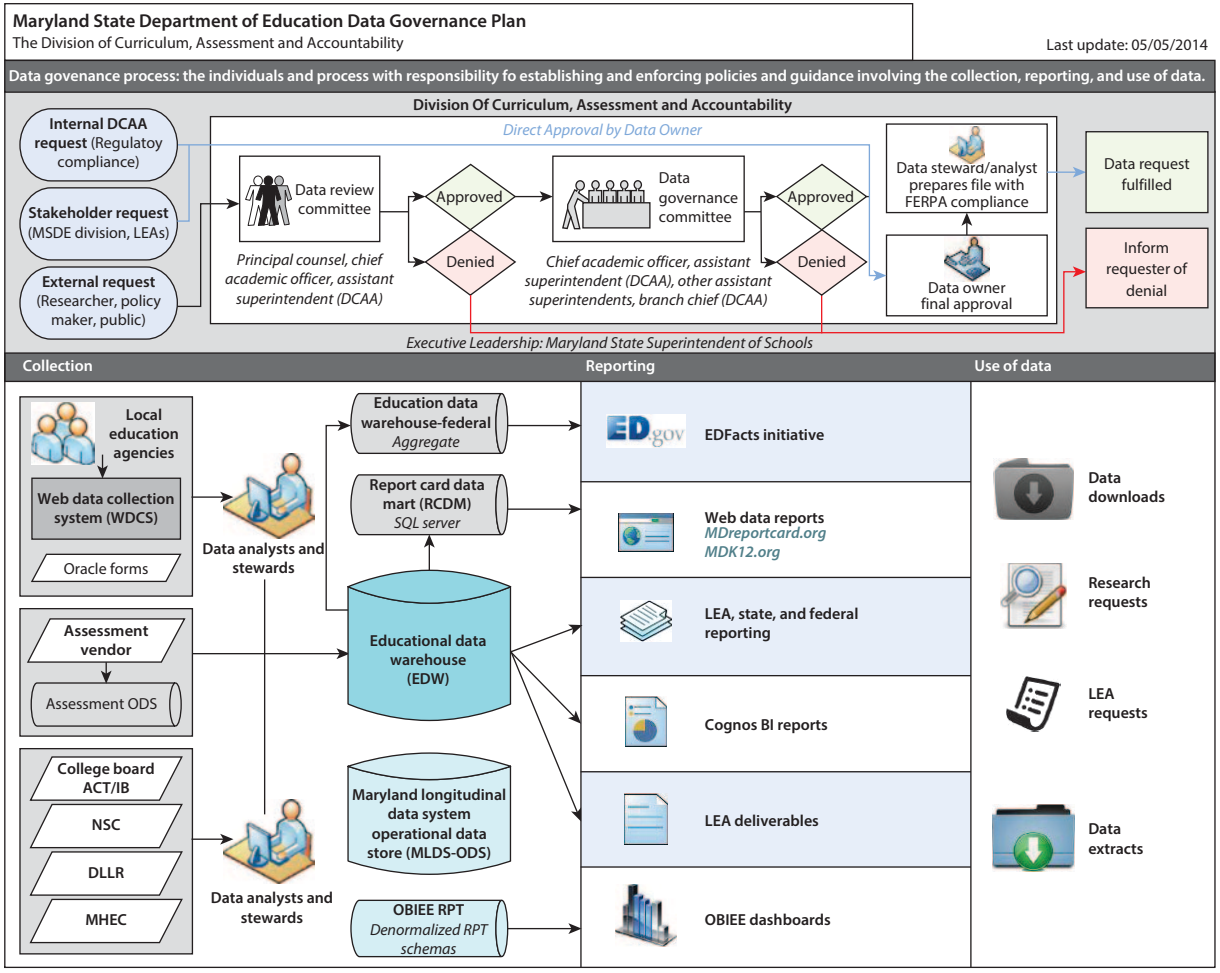
Network and data security is increasingly important given the growing threat of cyber-attacks. In January 2014, Maryland's Howard County Public School System experienced a series of power outages that may have been related to a cyber-attack (Toth 2014). Later that year, Prince George's County Public School System reported a security breach involving employees' personal data, including Social Security numbers (Wiggins 2014). Across the nation, similar attacks are reported on a regular basis. Schools and counties have access to a wealth of student and employee data, from attendance records to health records, and experts emphasize the need for education leaders to be prepared for cyber-threats (Lestch 2015).

Education information systems at both state and local levels are regularly updated, and quality checks and audits are conducted internally and externally. The MSDE conducts gap analyses and regularly compares data structures to national data models to identify potential areas for improvement. In accordance with the Data Quality Campaign's 10 Essential Elements of Statewide Longitudinal Data Systems, Maryland established Element 10, a state data-audit system for assessing data quality, validity, and reliability.

The MSDE follows strict data governance procedures. The Department's Data Governance Plan (figure 3.2) outlines the people and processes responsible for establishing and enforcing policies, as well as guidance with regard to collection, reporting, and use of data. This type of plan is important considering that many different types of institutions make data requests from the Department on a regular basis. Such data requests come from within the Division of Curriculum, Assessment and Accountability itself, or from other divisions within the Department. Requests also come from external sources, including research institutions, the general public, media, and policy makers.

The data governance plan shows that a request for data will first go through the Data Review Committee. If approved, the request undergoes another layer of approval with the Data Governance Committee, consisting of the Chief Academic Officer, Assistant Superintendent of the DCAA, other Assistant Superintendents, and the Branch Chief of DCAA. If the request is approved again, it moves onto a Data Steward/Analyst, who will prepare the file in compliance with the FERPA. The Data Governance Plan also illustrates key aspects of data flow, from collection, to reporting, and finally to utilization.

Figure 3.2 MSDE Data Governance Plan



Source: Adapted from MSDE 2014b.

Notes

1. COMAR 13A.08.02.07: http://www.dsd.state.md.us/comar/comarhtml/13a/13a.08.02.07.htm.
2. COMAR 13A.08.02.04: http://www.dsd.state.md.us/comar/comarhtml/13a/13a.08.02.04.htm.
3. COMAR 13A.08.02.06: http://www.dsd.state.md.us/comar/comarhtml/13a/13a.08.02.06.htm.
4. Maryland Student Records System Manual: http://marylandpublicschools.org/about/Documents/DSFSS/SSSP/MDStudentRecordsSystemManual2016.pdf.

CHAPTER 4

Fulfilling the Promise of Data to Ensure Learning

In Maryland, data utilization is embedded in the policy framework and enhanced through a common culture that recognizes the value of data. With this foundation, data are utilized in decision making by different stakeholders at all levels of the education system, including policy makers, principals, teachers, administrators, parents, and students (photo 4.1). Parents and students have real-time access to student learning data. Teachers use data to track progress toward student learning objectives (SLOs). Principals and school administrators actively use data to evaluate teachers, monitor school progress, and manage school plans. Policy makers use data to monitor education quality and equity, improve accountability, and gauge effectiveness of policies and programs.

Data are also accessible to the general public and media, and to researchers for academic pursuits. However, utilization of data in the classroom for instructional gains varies between counties, with the practice more commonplace in some counties than others. Further, digital learning programs used in the classroom are often not recorded in the county data system, missing an opportunity to collect another aspect of student-learning data. Utilization would be stronger if more collaboration were to exist among counties. Indeed, minimal collaboration among counties limits opportunities to learn from peers, share resources, and strengthen systems. Opportunities to share resources would be especially helpful for counties operating on lower budgets. If constructed effectively under an overarching data system strategy, counties could benefit from collective bargaining power and more efficient use of resources. The Maryland State Department of Education (MSDE), meanwhile, could leverage statewide experience in education data systems implementation to ultimately achieve better education results.

Bringing Data to Life in the Classroom

At the school level, teachers and principals use data systems in a variety of ways, with data informing everything from classroom instruction to management. An effective data system empowers teachers to better use data, which in turn has the

Photo 4.1 EMIS Drives Collaboration between County and School Administrators

Principal of C. Paul Barnhart Elementary *(left)* and Assistant Superintendent of Instruction, Charles County, 2014.

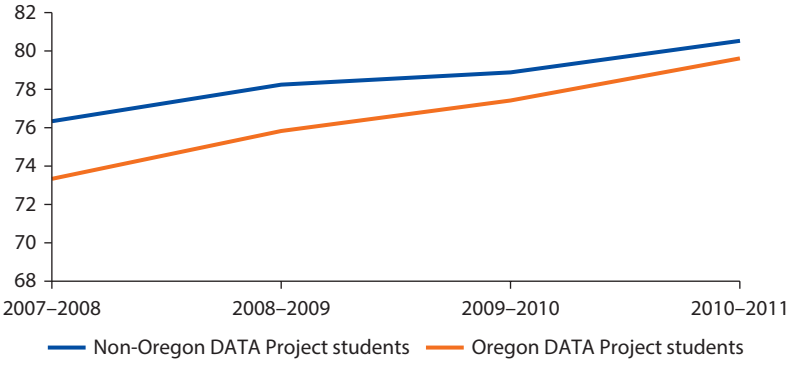
potential to improve learning outcomes. The Oregon Direct Access to Achievement (DATA) Project provided evidence linking data utilization to student learning results. The three-year, $4.7 million initiative sought to increase data utilization in the classroom, but worked from the premise that effective training is essential for helping educators utilize data effectively to strengthen student achievement.

In 2007, the Oregon DATA Project set out to train teachers on the value and use of data to enhance classroom practice and improve student learning, by giving them the resources to collect, analyze, and use longitudinal data (Data Quality Campaign 2012). The project led to a change in the way teachers valued and used data, which in turn had positive outcomes for student achievement.

A project evaluation report (Dunn 2011) confirmed that at the onset of the project, schools that participated in the Oregon DATA Project had lower achievement numbers than nonparticipating schools. After just two years, the percentage of students at or above proficient on the state test grew at a significantly higher rate than for students in schools whose teachers did not receive training, and the achievement gap between the two groups of schools decreased in reading and closed in math (figures 4.1 and 4.2).

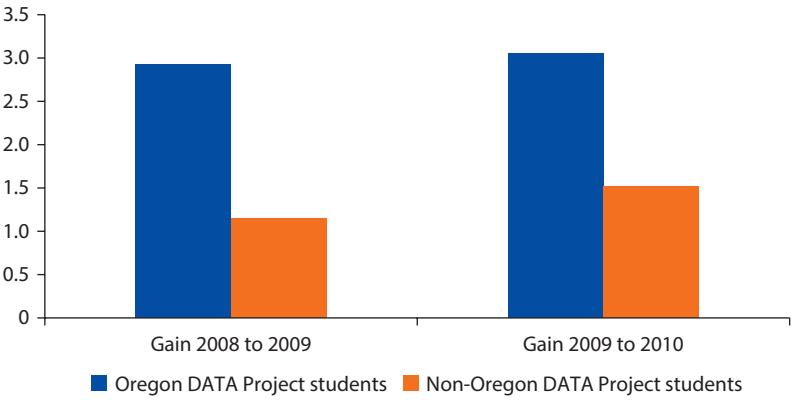
Professional collaboration can contribute to a data-driven culture. Teachers participating in the Oregon DATA Project were eager to collaborate with one another on the interpretation and utilization of data in the classroom. This outcome is supported by a growing body of evidence that suggests that collaborative work with data may accelerate interest in, and use of, data among educators (U.S. Department of Education 2011; Wayman and Stringfield 2006; Chen et al. 2005).

Figure 4.1 Making the Connection between Data and Learning: Four-Year Trend in Percentage of Students Meeting or Exceeding Proficiency Thresholds in Reading



Source: Dunn 2011.

Figure 4.2 Making the Connection between Data and Learning: Comparative Gain in Percentage of Students Meeting or Exceeding Proficiency Thresholds in Math for Years 1 and 2 of DATA Project Implementation



Source: Dunn 2011.

In Maryland, teachers use data to track progress toward SLOs and to better understand student needs in general. Teachers use the objectives to design and evaluate their instruction. The SLOs are measurable instructional goals established for a specific group of students over a set period of time. They also serve as one of the measures of student growth for the State Teacher Evaluation model, and the results may determine 20–35 percent of a teacher's evaluation. An effective education data system is a critical tool for teachers throughout the SLO process. The process begins with the planning and documentation of intended objectives, and then proceeds to capturing a baseline of student knowledge. The next step is the design and delivery of curriculum, followed by another assessment, and finally analysis and utilization of student learning outcomes data. Teachers utilize an information system throughout this process to

track student progress and to assist them in answering questions such as the following:

- What do students know and not know before and after the curriculum is delivered?
- Do gaps exist in the curriculum that prevent students from learning?
- Do certain students have special needs and require further intervention?
- Are such interventions working?
- Is a student's poor performance due to absence or inability to understand the content?

Cecil County uses a sophisticated information system that combines demographic student data with instructional data to track student learning by various disaggregated demographics, such as gender and ethnicity. An Academic Index pulls data on academic factors that may impact success in school, such as Absence, Discipline, and Assessment Scores. In addition to tracking general class performance, this report serves as a predictive tool to identify students at risk of dropping out of school. The Academic Index is calculated based on cut-off points, with four or more points displayed in orange (indicating need for intervention), two or three points displayed in blue, and no or one point displayed in green (table 4.1 and figure 4.3).

Teachers gain greater insight into the classroom, and supervisors benefit from aggregate data. Reflecting on the Academic Index, Regina Roberts, Principal of a school in Cecil County, said, "This is a system that builds off of what teachers already know individually and creates incredible value by aggregating that knowledge in an efficient, easy-to-use format. We can interact with information

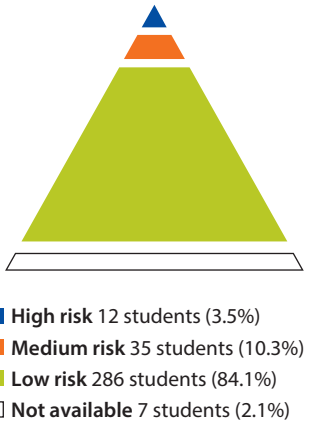
Table 4.1 Cecil County Academic Index

Assessments		
Grades (*no. of Ds or Fs)*	0	**0**
Grades	1	**1**
Grades	2	**2**
Grades	3+	**3**
Discipline (suspensions per school year)		
Suspensions	0	**0**
Suspensions	1	**1**
Suspensions	2–3	**2**
Suspensions	4+	**3**
Attendance (excused & unexcused)		
Absences	91–100%	**0**
Absences	85–90%	**1**
Absences	80–84%	**2**
Absences	0–79%	**3**

Source: Provided to Authors by Cecil County 2014.

Figure 4.3 Academic Index: Marking Period 1

School name
Current grade: 6
Total enrollment: 340



Source: Cecil County 2014.

in a more dynamic way to address student needs. Teachers—and principals as well—have access to information that significantly shifts the way we do business, making it more efficient, reliable, and fast" (Interview with Authors 2014).

Utilization of data in the classroom for instructional gains is expanding; however, often the programs being used are not linked to the local-level education data system, missing an opportunity to collect a deeper layer of student-learning data. Learning programs such as DIBELS, Fountas & Pinnell, Scholastic Reading & Math Inventory, and many others are commonly used in the classroom, but data are not fed into the county data system. This is more of a technical integration gap that vendors should work to improve. However, the MSDE could monitor for, identify, and suggest to counties any instructional programs with good integration capabilities.

Education information systems can help cultivate a culture of data utilization among teachers. In Maryland's Kent County, the school system uses SchoolNet, a product under the Pearson-owned PowerSchool student information system. SchoolNet combines student information with instructional data and allows teachers to create, store, and share their own mini-assessments (also referred to as formative, or short-cycle, assessments). As SchoolNet was being launched, the school was also rolling out a professional learning community model—a workplace strategy to foster collaborative learning among colleagues.

The SchoolNet data system, combined with the collaborative, professional learning community framework, was catalytic for teachers, who immediately started collaborating around assessment data (photo 4.2). Karen Couch, Superintendent of Kent County, described the benefit of the combined tools: "We have become more sophisticated in understanding the value of a benchmark

Photo 4.2 Collaboration Drives Teacher Utilization of EMIS

Teachers in Kent County collaboratively examine progression data.
Source: *Education Week* 2014.

test and the resulting data." She added, "Independently, it changed how teachers view assessments and how they use data in planning their [Student Learning Objectives]. Collaboratively, it transformed the dialogue and collaboration between teachers to be more data-driven and more energetic. They are required to meet twice a month, but many now meet once a week to collaborate and discuss data. Walking together as a collaborative culture ensures the effective use of data is a true partnership." (Interview with Authors 2014).

Professionalizing School Planning and Management

Across Maryland, principals use education data systems to manage staff and plan more effectively. They rely on data to understand, and make decisions about, their schools. Principals use data to answer many questions, such as

- Are the teachers in my school effective, and are students learning?
- Am I on track to meet district and state student-teacher ratio goals?
- Is learning at my school equitable, and is it fair across demographic groups such as gender and ethnicity?
- Is professional development effective, and what is the return on investment in professional development?
- What is my school budget, and is it managed efficiently?

Charles County worked with vendor Insystech to customize The Evaluation & Assets Management System (TEAMS). While the system works best on the cloud in an environment with Internet, it can also be customized for regions without Internet or with limited Internet access. Because Charles County has

consistent Internet access, the full capabilities of the system are available, including Staff Evaluation, Admin Management, Student Assessment and Student Information Systems, Asset Management, and Search.

Principals were brought in to help design the evaluation system, and they now use it throughout the evaluation process. This user-driven design process helped to create a product that truly responds to the needs of principals. Specific user requests included spellcheck, automatic saving every 30 seconds, and color codes to differentiate automatic and manual correlations.

The Asset Hub allows teachers to share, vet, and collaborate around instructional assets. Teachers also have the opportunity to rate these assets. Assets with higher ratings float to the top of the system, making them more visible to users, while weaker assets drop to the bottom of the list. Asset management makes teaching more efficient and collaborative.

In addition, an automated, intuitive evaluation system helps to speed up the teacher-evaluation process, and to improve the quality of evaluations. Previously, it took a principal between four and five hours on average to complete one evaluation. That process involved scheduling a class observation, conducting the observation, writing up notes, analyzing notes, scheduling a follow-up, and finally meeting with the teacher to discuss results. Maryland state law requires two evaluations per teacher per year. Due to the inefficient process, many principals put off the task until the end of each semester. Then they had to rush to get through stacks of evaluations by the deadline. The purpose of the evaluation—as an instrument to monitor and strengthen the skills of teachers—was largely lost.

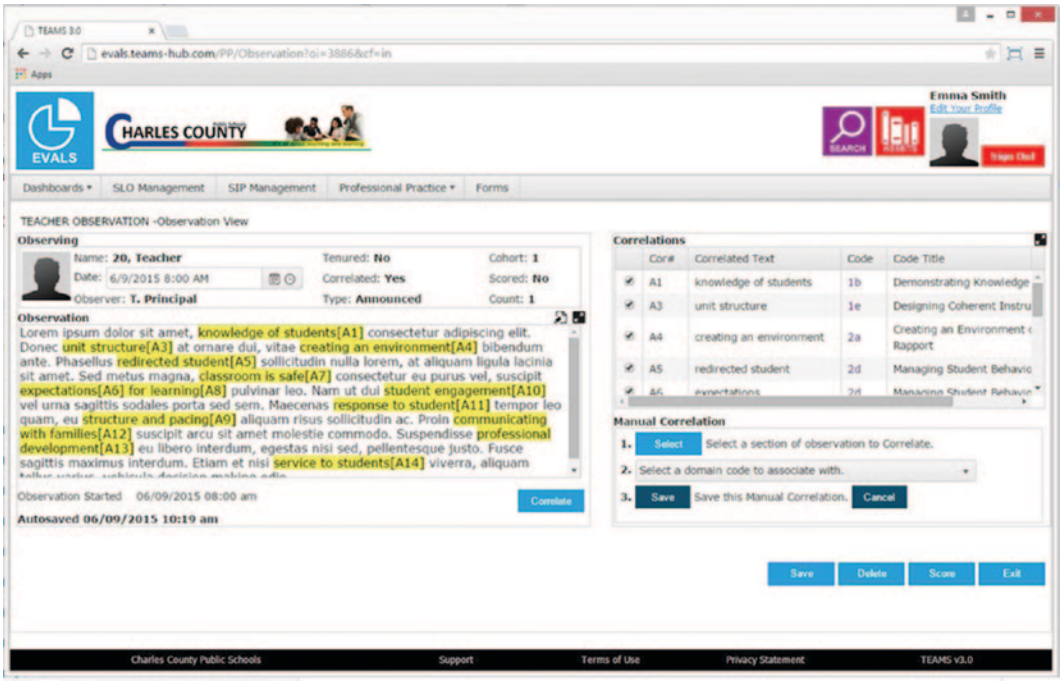
The new, automated system supports principals in scheduling observations, collecting and managing notes, and sharing documents. Principals use the calendar invite to schedule an initial observation with the teacher. During the observation, they take notes directly in the system, on a tablet or laptop. Following the observation, they review their notes, then click "Correlate." That tells the program to automatically select phrases from the notes that are relevant to the state evaluation methodology (box 4.1) and correlates the notes with the

Box 4.1 Teacher Evaluation Model: An EMIS Opportunity

The state evaluation model examines a 50/50 split between qualitative professional practice measures (inputs) and quantitative student growth measures (outcomes). Based on the Charlotte Danielson Framework, four practice domains are evaluated that comprise qualitative professional practice: (1) planning and preparation, (2) instructional delivery, (3) classroom management and environment, and (4) professional responsibilities. Performance in each domain is worth 12.5 percentage points. The TEAMS teacher evaluation product includes both qualitative and quantitative measures, effectively comparing teacher inputs with student outcomes. Integrating this model with the education data system provides an opportunity to effectively track teacher inputs and student-learning outcomes over time.

Source: MSDE Teacher Professional Practice: http://www.marylandpublicschools.org/msde/programs/tpe/tpp.html.

Figure 4.4 Innovation in Data Collection for Teacher Evaluation



Source: Provided to authors by Insystech 2015.

relevant domains, saving principals from having to rewrite notes into the evaluation framework (figure 4.4).

Principals have the opportunity to edit their entries in the domains in case anything was missed in the automated correlation process. During training, Charles County principals learned how to use terminology to maximize correlations; they can also add to, or revise, the correlation taxonomy in the system. Next, the correlated domains are transferred into the framework for scoring. The principal scores on a scale of 1–4, with an option to add notes next to each score. Scores and notes are aggregated over time to show changes in professional development. Perhaps the most critical aspect of the tool is that it cultivates conversation and transparency. After each observation, the teacher has access to the scores and write-ups before he or she meets with the principal to discuss results. This approach can help to reduce surprises and encourage dialogue that is truly focused on teacher professional development.

Kim Hill, Superintendent of Charles County, emphasized the importance of the dialogue between principal and teacher. "Throughout development and design of this product, principals were at the table. They were demanding, as they should have been, because they were taking away obstacles and barriers. Their insights focused on what is important, which is the conversation." Amy Hollstein, Assistant Superintendent of Instruction, agreed. "The best part of the

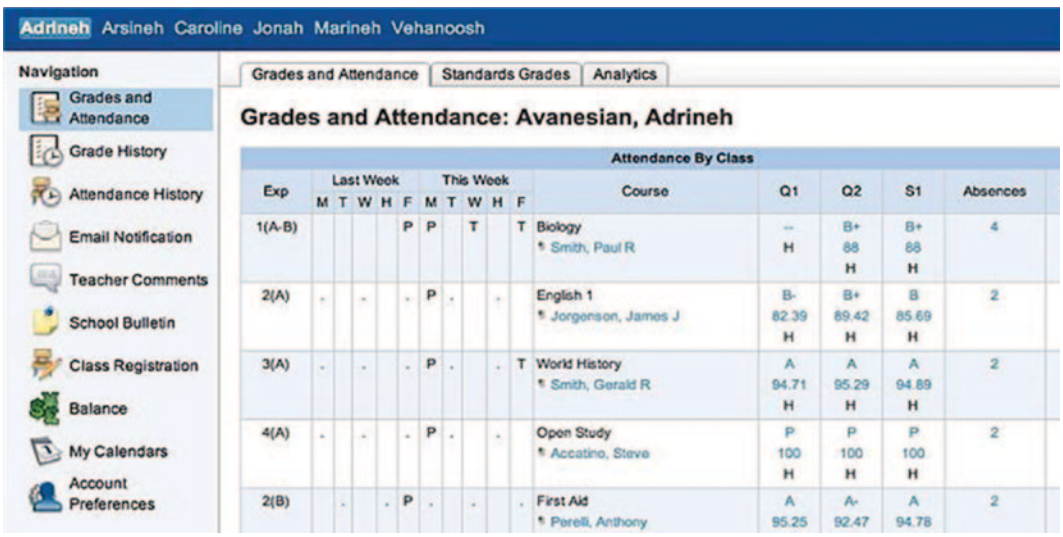
whole process is the dialogue between the principal and the teacher. We call it the courageous conversation." (Interview with Authors 2014)

With the school management system in place and integrating with student-assessment data, shifts are occurring in the work culture. A focus on true professional development—genuine improvement of teaching and management expertise—has taken hold. All parties are happy with the system, which is quick, easy to use, and accurate. "It sounds so simple, but it is so incredibly profound," said Dr. Smith, as he reflected on Charles County's success, "To help your staff develop as professionals from the day they walk in the door is a huge step in the profession, a fundamental shift that raises the level of professionalism for teachers and principals." (Interview with Authors 2014)

Continuity in Learning from the Classroom to the Home

Across Maryland, parents and students are actively using education information systems to access assignments, grades, and even homework that helps support children's learning. Figure 4.5 provides an example from vendor, Performance Matters, of a parent-student interface. The platform includes grades and attendance, grade history, teacher comments, and a variety of other information that creates transparency and fosters communication and collaboration among parents, students, and teachers. With advancements in technology, especially mobile technology, students and parents interact directly with education information systems more frequently. System vendors are increasingly focused on building mobile applications for education stakeholders and others, so that they can interact with the system on the go.

Figure 4.5 Performance Matters Student and Parent Dashboard



Source: Performance Matters, sample dashboard 2014.

The success of these efforts to share information hinges on the effectiveness of the education data system. An effective system can reliably share information in a timely manner to improve school accountability and increase parent engagement. In the long run, such practices have the potential to improve student learning outcomes and system efficiency.

Driving Accountability and Education Reform

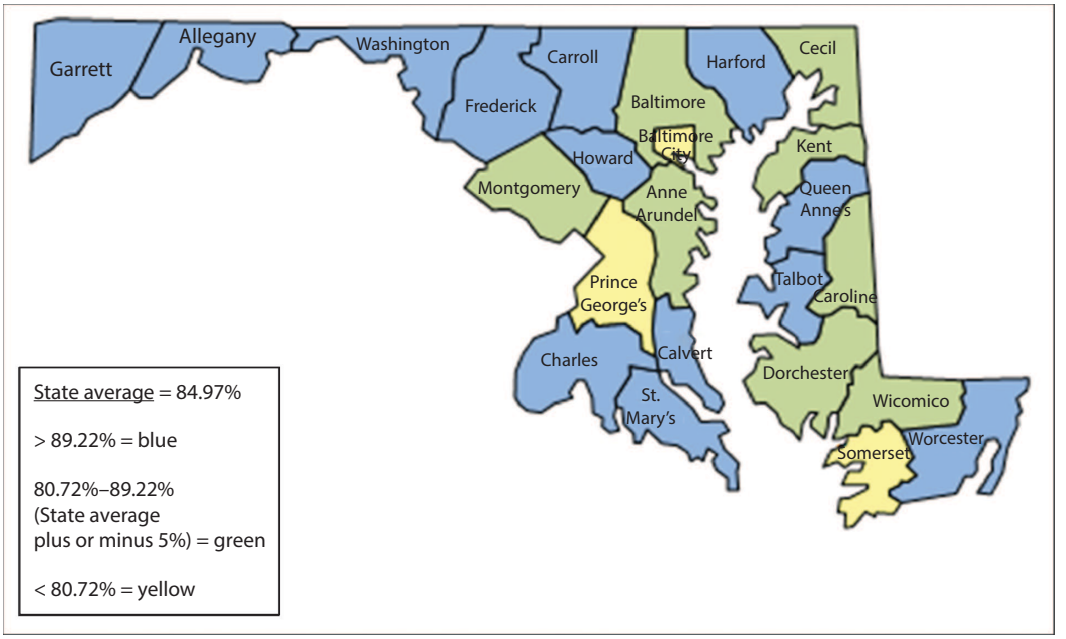
Policy makers use data to monitor education quality and equity, and to inform planning. Using data to monitor quality is not easy, especially when it comes to communicating results in a way that effectively brings about results and does not alienate or antagonize stakeholders. For example, transparently disseminating aggregate examination results or graduation rates across a state or country informs all education stakeholders about the health of the education system. Yet challenges may arise for low-performing states or districts.

Administrators and decision makers in regions with lower results may dispute the data, try to divert responsibility, or use other methods to defend their performance. Such tactics fail to improve the situation and often run the risk of making conditions worse by spreading negative attitudes. The responsibility falls on policy makers to share data in such a way that negative responses are minimalized and, instead, stakeholders are encouraged to collaborate and improve.

Maryland developed an effective and collaborative strategy for sharing cohort graduation rates with county decision makers. Instead of disseminating the actual graduation rate of each county, policy makers calculated the state average and shared data related to that average (map 4.1). Green counties included those that were within five percentage points above or below the state average. Blue counties were those that scored above that bracket, and yellow were those below that bracket. Policy makers carefully selected coloring as well. Instead of using traditional colors—for example, coloring low-performing counties in red—policy makers used neutral pastel shades, so as not to invoke an immediate defensive response. When stakeholders convened to discuss the data, the result was a meeting characterized by productive dialogue and action, as opposed to one filled with defensive and divisive conduct.

A key tool that policy makers in Maryland use to hold schools accountable is the School Progress Index (SPI), which reports education data and analysis through a transparent platform. The state set up the Index in response to federal reforms to the No Child Left Behind (NCLB) Act, which initially tracked accountability through Adequate Yearly Progress (AYP).[1] In 2011, the U.S. Department of Education gave states the opportunity to develop a new system for measuring and reporting school performance. Maryland redesigned its accountability system, focusing on the progress that schools are making toward improving student achievement, closing achievement gaps, and enabling students to move toward readiness for college and career by mastering grade- and course-level curriculum goals each year (MSDE 2012b).

Map 4.1 Collaborative Approach to Sharing Cohort Graduation Rates



Source: MSDE 2015.

The change is further evidence of Maryland's transition from a compliance-focused system to one that targets student growth and learning. The SPI provides more in-depth, student-level information than AYP, which simply tracked how a school's scores would change from year to year (figure 4.6). The Index evaluates schools on a continuous scale based on the variables of Achievement, Growth, Gap Reduction, and College- and Career-Readiness. It also makes results of each school available publicly via the annual Maryland Report Card. The Index identifies schools for intervention, support, and recognition, depending on their progress.

The Index is based on multiple measures that include student-achievement data in English/language arts, mathematics, and science; growth data in English/language arts and mathematics; gaps, based on the gap score between the highest-achieving and lowest-achieving subgroups, in mathematics, reading, and science; and cohort graduation and dropout rates.

The Index guides interventions from policy makers by categorizing schools into one of five strands, which determines the support each school receives from the district and state. The state affords top-performing schools with greater flexibility, while lower-performing schools receive progressively more prescriptive technical assistance, targets for performance, and monitoring.

During the transition from AYP to the SPI, the MSDE took care to communicate continually about the reform and what it meant for schools, staff, students, and parents. Maryland Classroom (Vol. 18, No. 3)[2] is a good example of

Figure 4.6 Maryland School Progress Index

Source: reportcard.msde.maryland.gov.

this communication effort, featuring a "frequently asked questions" section, and providing detailed information on methodology and ways for utilizing the index.

Appendix D shows the index results for Forest Hill Elementary in Maryland's Harford County. Various tools are built into the webpage to educate the user about how to understand and use the index. The SPI is reported through the Maryland Report Card, which also contains demographic data, enrollment and attendance rates, absentee rates, student mobility, teacher qualifications, and data about students receiving special services. A similar utilization of the EMIS was tremendously successful in Australia and is detailed later in this section.

For a strategy such as the SPI to be successful, schools must have the tools to effectively design and achieve improvement plans. To effectively position schools for success, national, state, and local governments provide schools with data that they can use to benchmark their students' performance against student

performance metrics at local and national levels, as well as tools to organize and analyze that data.

Maryland's Howard County provided school management with an Excel table to track improvement plan performance data. Table 4.2 shares a portion of that table, tracking national performance measures over a five-year period, including national-, state-, and local-level performance results. The County provided a separate table for each school to track student-level progress on state and local exams. Providing templates to schools not only makes recording easier at the school level, but also improves data-sharing by limiting multiple versions and formats of documents that essentially track the same information.

Australia's My School platform (myschool.edu.au), which launched in January 2010, is a critical component within a set of national education reforms that transformed data and reporting processes to increase accountability and improve education outcomes. The education information system played a fundamental role throughout the reforms and the creation of My School.

Before these reforms took place, the Australian government struggled with unreliable data. Communities, especially parents, did not have access to data, and therefore had little ability to understand how their schools fit into the larger picture and had few ways to exert any influence over instruction. Further, Australia had no nationally comparable, single source of data.

Under the management of the Australian Curriculum, Assessment, and Reporting Authority (ACARA), My School has grown to include information about each school's student population, the average achievement of students in the National Assessment Program (an annual assessment), and indication of student progress over time. The platform also incorporates school financial data, comparable across all Australian schools, as well as other useful data, such as attendance rates and staff numbers at each school (ACARA 2014). Appendix E presents a sample school profile and demonstrates the comprehensive data available in a simple user interface.

Not only have parents and communities benefitted from access to transparent data, but policy makers also have used it to inform decision making in Australia. A number of key reforms have been guided by My School data, including a review of Australian government education funding, and the Making Every School a Great School program. Australia's example offer several policy lessons that may be especially relevant for countries with a federal-state system (OECD 2012):

- Buy-in from leadership was essential
- Policy makers made a commitment to lengthy consensus building, spanning nine government departments
- Additional funds from the Australian government supported the project
- Project leaders made an effort to communicate with the community, including explaining its rights to information.

Table 4.2 School Improvement Plan Based on Data and Results

National Performance Measures	Trend data										Targets					Benchmarks			
	2011		2012		2013		2014		*2015*		2015	2016	2017	2018		College and career readiness			
PSAT G10	N	%	N	%	N	%	N	%	N	%	Percent				College and career	National (2009)	MD (2014)	S (2014)	S (2015)
PSAT Composite	1709	41.4	1630	41.8	1557	40.5	1569	39.9	1583	41.7					145	27	NA	39.9	41.7
PSAT Math	2168	52.5	2011	51.6	1914	49.8	1861	47.3	1982	52.2					47	35	NA	47.3	52.2
PSAT Critical Reading	1680	40.7	1613	41.4	1497	38.9	1634	41.5	1570	41.4					49	27	NA	41.5	41.4
PSAT Writing	1563	37.8	1429	36.7	1486	38.6	1487	37.8	1487	39.2					48	26	NA	37.8	39.2
PSAT Participation Rate	4131	90.3	3899	91.6	3847	95.0	3936	94.1	3796	95.6						NA	NA	94.1	95.6
PSAT G11	N	%	N	%	N	%	N	%	N	%	Percent				College Board	National (2009)	MD (2014)	S (2014)	S (2015)
PSAT Composite	1639	46.3	1815	47.0	1717	47.0	1742	47.7	1759	47.6					152	36	NA	47.7	47.6
PSAT Math	1901	53.7	2115	54.8	2037	55.7	1887	51.7	1982	53.6					50	44	NA	51.7	53.6
PSAT Critical Reading	1756	49.6	1905	49.4	1749	47.8	1894	51.9	1929	52.1					50	40	NA	51.9	52.1
PSAT Writing	1659	46.9	1707	44.2	1749	47.8	1882	51.6	1847	49.9					49	38	NA	51.6	49.9
PSAT Participation Rate	3539	87.0	3859	90.2	3656	91.1	3649	92.5	3699	92.5							NA	92.5	92.5

table continues next page

Table 4.2 School Improvement Plan Based on Data and Results *(continued)*

AP (Graduates)	N	%	N	%	N	%	N	%	N	%	Percent	College Board	National (2013)	MD (2013)	S (2013)	S (2014)
Enrolled in 1+ AP Course	2224	57.1	2076	54.2	2456	60.0	2319	60.7							60.0	60.7
Graduates Taking 1+ AP Exams	1816	47.8	1768	46.1	2037	49.7	2025	53.0					33.2	47.4	49.7	53.0
Earned a 3+ on 1+ AP Exams	1602	41.1	1518	39.6	1715	41.9	1712	44.8					20.1	29.6	41.9	44.8

SAT (Graduates)	N	%	N	%	N	%	N	%	N	%	Percent	College Board	National (2013)	MD (2013)	S (2013)	S (2014)
SAT Composite	944	45.1	1563	50.3	1755	53.2	1737	54.4				1650			53.2	54.4
SAT Math	1064	50.8	1743	56.1	1883	57.1	1856	58.1				550			57.1	58.1
SAT Verbal	305	43.2	1497	48.2	1675	50.8	1701	53.3				550			50.8	53.3
SAT Writing	898	42.9	1527	49.1	1716	52.1	1654	51.8				550			52.1	51.8
SAT Participation Rate	2095	53.8	3109	81.2	3296	80.5	3193	83.6							80.5	83.6

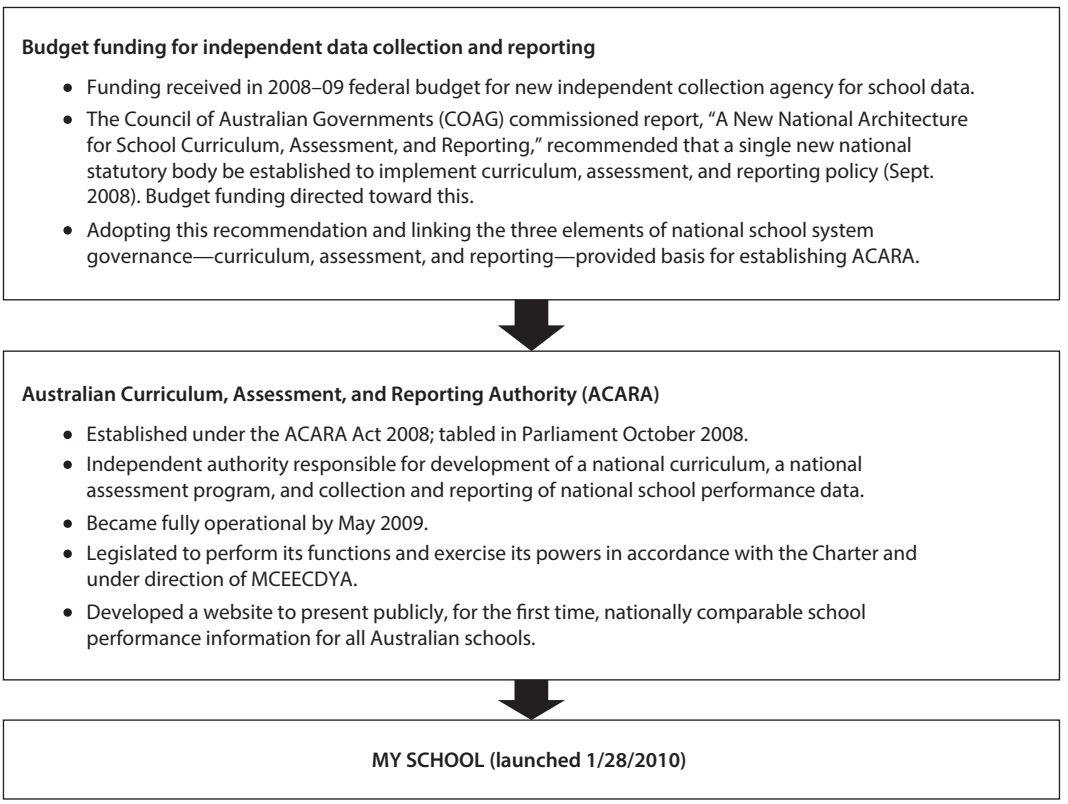
Source: Howard County 2015.

The journey to establish an effective accountability system is not easy. It requires leadership, the right enabling environment, and a broad cross section of committed actors. Figure 4.7 outlines the timeline and key milestones that helped My School establish the delivery capabilities for national school reporting.

Accountability systems evolve over time, usually in accordance with changes to assessment frameworks, curriculum standards, and other shifts in measurement and policies. In Maryland, the transition from AYP to SPI marked an initial effort to strengthen accountability, with the state moving from a binary (yes-or-no) framework, to one that is more multidimensional. With the launch of the Common Core standards and the PARCC assessment, the index will need to continue its evolution.

The MSDE is currently in the process of determining a new accountability framework, which will be submitted for approval to the State Board of Education. One area under consideration is the addition of a new indicator to complement the existing set of Achievement, Growth, Gap Reduction, and College- and Career-Readiness, by providing local context.

Figure 4.7 My School: Establishing Delivery Capabilities for National School Reporting



Source: OECD 2012.

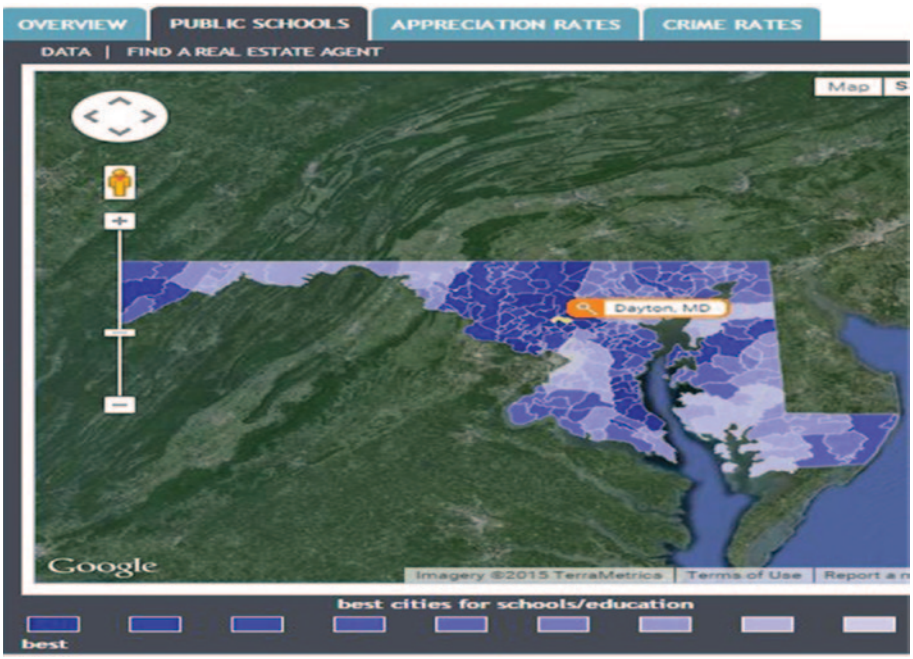
Creating Value beyond the Education System

A growing trend in Maryland, and across the United States, is the use of education data by non-education stakeholders. The private sector, including financial institutions and the real estate industry, provides one example. Map 4.2 shows a map of Maryland cities, with colors indicating the quality of public schools in each city. The website, Neighborhood Scout, touts its ability to provide enterprise data for every neighborhood and city in the country.

Education data on Neighborhood Scout comes from another company called Location Inc., which developed an algorithm that uses the student passing rate on the NAEP and state-specific test scores to build a nationally comparable school-quality index. This report does not comment on the validity of the Location Inc. index; however, its existence points to an interesting trend in education data that underscores the importance of a well-functioning education data system.

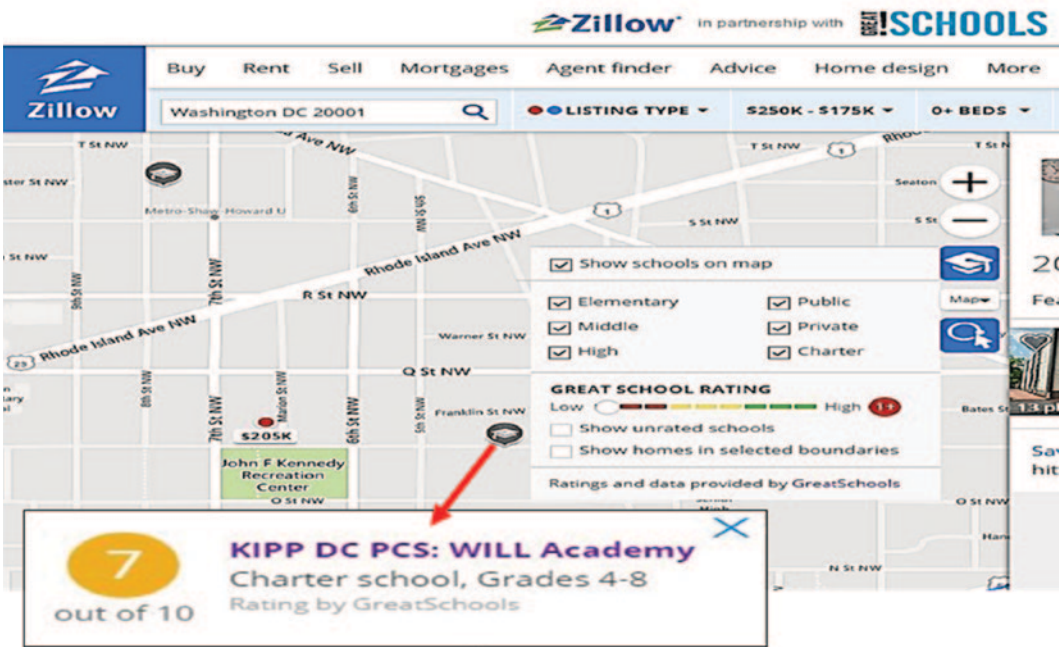
As data are increasingly valued and used across different sectors and industries, it is important that the institutions that collect and manage the data ensure the highest levels of professionalism and commitment to producing quality, timely information. Zillow is another example of a real estate company that integrates student data, from GreatSchools.org, an independent nonprofit organization that shares school information (map 4.3). Performance on standardized tests within each state makes up the majority of the GreatSchools Rating; however, in a

Map 4.2 Neighborhood Scout, Enterprise-Grade Data



Source: NeighborhoodScout.com.

Map 4.3 Real Estate Companies' Use of EMIS Data



Source: Zillow.com.

growing number of states where data are available, it includes additional information, such as how much students are learning in a given year and how prepared they are for college (GreatSchools.org 2015).

Notes

1. AYP is the measure by which schools, districts, and states are held accountable for student performance under Title I of the No Child Left Behind Act of 2001, the current version of the Elementary and Secondary Education Act.
2. Maryland Classroom: http://archives.marylandpublicschools.org/MSDE/newsroom/publications/pubs_md_classroom/index.html

CHAPTER 5

Continuous Improvement

Overall, Maryland's education data system is very strong, showcasing an array of good practices across key policy areas from which others can learn. The system derives strength from its advanced enabling environment and quality data (see appendix F). But even the most advanced systems have room for continuous improvement. Continuous improvement essentially means that decision makers are constantly evaluating their systems with a focus on identifying and filling gaps, upgrading technology, reforming policies, and innovating so that education stakeholders are supported by a robust and cutting-edge data system that drives student learning.

Tools for Continuous Improvement

One way to incorporate continuous improvement is to consistently run SWOT (Strengths Weaknesses Opportunities Threats) analysis. Table 5.1 outlines such a summary analysis for Maryland.

Maryland's strengths include that the highest levels of state and county leadership share a vision of the important role of the education data system. The system has the full support of decision makers and stakeholders across the education system, and strong policies position it for continued growth and success. Teachers are increasingly using data in the classroom, in part, a result of a strong data-driven culture. And the Maryland Longitudinal Data System (MLDS) is built on a strong foundation and integration strategy.

Opportunities for Maryland include potential for expansion of the MLDS Center. The system is well poised to push statewide, data-driven decision making to the next level, such as with the addition of more instructional-program data. Similarly, quality financial and human resources data are available to be fully integrated into the system, potentially boosting system-wide efficiency. Full implementation and utilization of the Student Course Grade Teacher collection will return new insights on what influences and drives student-learning outcomes.

Table 5.1 Maryland EMIS SWOT Profile

Strengths	*Weaknesses*
• Advanced enabling environment and quality data • Vision from decision makers, buy-in from implementers • Utilization in the classroom for teaching and learning • Strong data-driven culture • Strong integration strategy by Maryland Longitudinal Data System	• Slow progress integrating human resources and financial data with EMIS • Unequal resource distribution • Lack of collaboration among counties • Highly decentralized system that lowers efficiency
Opportunities	*Threats*
• Continued growth of longitudinal data system • National- and state-level grant programs • Expansion of assessment and instructional program • Availability of strong financial and human resource data • Completion and utilization of Student Course Grade Teacher collection	• Lack of a statewide Education Management Information Systems (EMIS) strategy • Changes in leadership • No systematic strategy for statewide data utilization training • Costly systems

Weaknesses in the Maryland data system center around variations in county-level systems, driven in part by unequal resource distribution. Counties that fall between state and local funding opportunities lack resources to invest in more robust data systems. Additionally, the state's highly decentralized and autonomous education system reduces potential for efficiency gains, such as through resource sharing, or by learning from successes and challenges of others. Such a system also reduces opportunities for collaboration among counties.

One threat to Maryland's data system is the lack of a statewide, data- and information-system strategy to guide progress and to support counties as they develop their own systems. Changes in leadership could reduce momentum around data management and utilization. In addition, costly systems, often supported by grants, can be challenging to maintain.

Making a Strong Data System Even Better

In many aspects, Maryland is at the forefront of innovations in education data systems. However, it would benefit from an overarching strategy to guide and encourage counties to reach the next level in data system implementation. With a decentralized education system and highly autonomous counties, the MSDE must continue to lead counties forward, rather than being led by them. A statewide strategy that conveys state goals and objectives, as well as customized milestones for each county, would help the Department deliver on its leadership role. With a strategy in place, it becomes easier to identify opportunities to offer strategic support, cultivate learning between counties, and collectively hold one another accountable.

A statewide strategy would also bring cohesion and alignment to the numerous state and federally funded grant programs that are relevant to the education data system (table 5.2). In some cases, such as the MDK12 initiative funded by the Office of Educational Research and Improvement, the MSDE maintained the program, though its connection to, and alignment with, the Department are not entirely clear. Improved coordination and alignment of these initiatives under an overarching strategy could make them more effective, accessible, and sustainable.

An important component of a statewide strategy should target equitable resource distribution and support mechanisms across counties. Education data system implementation in Maryland clearly varies significantly across counties. The MSDE should prioritize support to counties with fewer resources and help them to achieve realistic milestones.

A final consideration for the proposed statewide strategy is inclusion of an analytics agenda to continue Maryland's momentum around a learning-driven approach to data management and utilization. The state's Longitudinal Data System LDS) is certainly evidence of progress in this area. Education policy makers should continue driving these efforts by communicating long-term goals and helping counties to identify and reach their own objectives around analytics.

Maryland has made steady progress in evolving from an education data system that is dominated by a compliance focus, to one driven by learning and innovation, though additional improvements can be made. To summarize, a compliance-focused system is characterized by an extreme focus on reporting to comply with state and federal policies. A system that is driven by learning will be fully compliant, but will also use data in more innovative ways to cultivate student learning and provide insights into the education system. Such a focus allows decision makers at all levels to understand what drives student learning. Maryland could accelerate this evolution by doing the following:

- Providing more tools and resources that assist educators in using data during classroom instruction; the Oregon DATA Project is a good example of a statewide effort to provide training and support for data-driven decision making

Table 5.2 Summary of Federal and State Grants That Could Be Aligned under State EMIS Strategy

Project	*Grant type*	*Amount*
Maryland Longitudinal Data System (2006, 2009, 2012)	Federal grant awarded to MD	$5.6 million (2006); $5.9 million (2009); $3.9 million (2012)
Race to the Top (2010)	Federal grant awarded to MD	$250 million
State Fiscal Stabilization Fund (2010)	Federal grant awarded to MD	$2 million
EMIS-specific grants for new system (2014, 2015)	State grant from MSDE to Howard County	$700,000 (2014); $65,000 (2015)

- Hosting meetings, conferences, or workshops on the topic of data utilization for learning and
- Creating positive incentives for teachers and schools that are leaders in using data for learning.

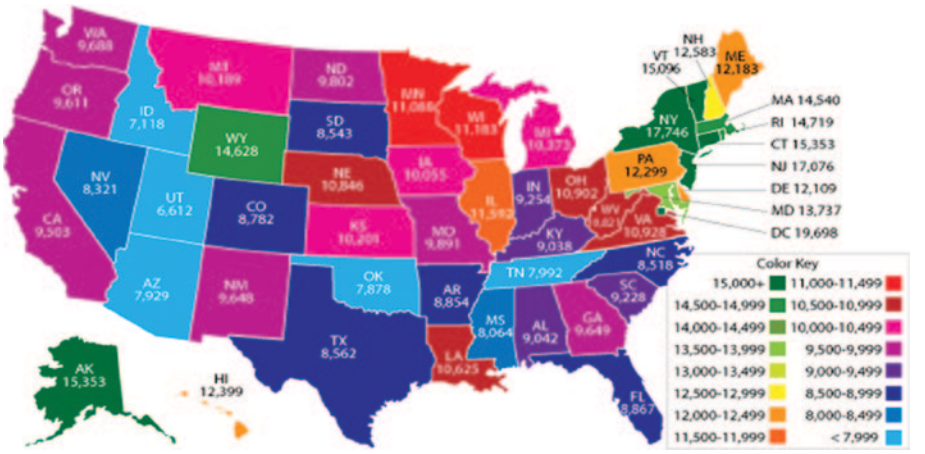
A variety of digital instructional programs (e.g., DIBELS, Dreambox, Conceptual Math) are being used in classrooms, but data from these programs are not consistently reaching the education information system. While this speaks to a larger technology challenge, some of which depends on private sector solutions, finding ways to continue adding learning-outcomes data to the school-level data system is key. The MSDE can play a key role by incentivizing collection of formative-assessment data and identifying and suggesting instructional programs that have greater integration capabilities with the education data system. For example, schools in Anne Arundel County integrate Fountas & Pinnell data into its county-level data system, Performance Matters. Effectively collecting summative-assessment data is a strong first step; the next step is finding ways to collect, manage, and track formative assessments and real-time student-learning data. This results in a more comprehensive and holistic view of what influences student learning. It also increases the value of instructional programs so that they don't just benefit a single teacher or classroom, but potentially advance the entire system.

The EMIS is not being fully leveraged to increase efficiency across the education system. At both state and county levels, a variety of siloed databases manages and tracks human resources and financial data. Efforts to incorporate this data into the education data system would improve the ability to track inputs and measure value-for-money across the system. Bringing the data together is an essential part of tracking efficiency and effectiveness across the education system. Nationally, Maryland usually ranks among the highest in per-pupil expenditures (map 5.1). While this can certainly be a positive indicator, pointing to strong investment in education, it can also reveal inefficiencies in spending. Without fully integrated data, decision makers cannot defend efficiency across the system.

Several cutting-edge education data system initiatives are underway in Maryland but have not yet reached completion, statewide institutionalization, or utilization. For example, the Student Course Grade Teacher collection is an exciting program that links teachers and courses with student-learning outcomes, but it does not appear to be complete. When finished, this innovation will provide principals and administrators with tremendous insight into the efficacy of their teaching staff, as well as additional information related to student-learning outcomes. Similarly, efforts to operationalize and fully utilize the MLDS will also mark an exciting milestone for the state. The Florida LDS provides a concrete example of how a state was able to institutionalize such a system and drive utilization across different levels of the education system. Maryland should complete these initiatives and provide training on how to use the data in management.

Some gaps in communication and coordination appear to exist around data sharing at the MSDE. While the Department tries to establish clear processes for when and how to share what data, some counties report that, at times, it makes

Map 5.1 Per-Pupil Expenditures, U.S. Public Elementary and Secondary Schools, 2008–09



Source: U.S. Department of Education 2009.
Note: National average: US$10,591; median: US$10,189.

changes to data requirements, requests data outside of designated times with short notice, and requests data that have already been collected. This suggests gaps exist in coordination and communication. Better communication within the Department, as well as transparent platforms that communicate requirements and deadlines (such as found on the Ohio Department of Education website), could redress some of these concerns.

Maryland has missed opportunity around collaboration among counties. Maryland's counties are each doing innovative and exciting work with regard to education data system implementation, but they are not sharing ideas or lessons learned across county borders. This type of sharing would be especially useful for counties with smaller budgets and fewer resources to commit to their data system. One suggestion that continually came up during interviews was the need for more formative assessments and exemplary lessons. Counties with larger budgets, or those that received grants, often hire outside professionals to help them develop such learning tools. Counties with limited resources would benefit from a mechanism that makes these tools accessible across the state. Programs that integrate with education information systems, such as Insystech's TEAMS product, can build "asset hubs" that allow instructional materials to be aggregated, organized, shared, and even rated by users.

State Responsibility for a Strategic Vision

Many of the recommendations refer to the potential benefits of a statewide EMIS strategy in Maryland. This section shares ideas about *how* such a strategy could be developed and delivered. The MSDE carries the important responsibility of steering statewide education results toward collective success. An overarching

system strategy could support the Department in this mission by leveraging policies, standards, and incentives to cultivate collaboration, cost-sharing opportunities, and learning networks. Communicated effectively, such a strategy would serve as a one-stop shop for all stakeholders, including a hub for tools, resources, reporting schedules, and milestones. The strategy could also provide counties with collective-bargaining power. Aggregated content made available through the strategy could include items such as the following:

State Level

- Education data system strategy vision and milestones
- Repository of system policies, standards, manuals, and strategic documents
- Schedule of data-reporting deadlines
- Upcoming grant opportunities relevant to data system
- Upcoming data system collaboration activities (e.g., webinars, convenings)
- Data system hub with state and county resources (e.g., training materials, presentations, system documents such as wireframes)

County Level

- Summary data system profile: a simple overview of each county's system and key system contact(s)
- Technology plans and data system strategic documents
- Reviews of vendors, technology systems, and other materials.

An overarching data-system strategy would serve as a tool to support the MSDE in encouraging diverse and innovative counties to work together to achieve statewide education goals. The strategy could also help the Department to capture and share the rich clusters of knowledge that each county develops in implementing its own education data system.

From the perspective of counties, the strategy should provide a centralized menu of options where stakeholders could find tools and resources relevant to their needs. The aim is that regardless of the unique needs of each county—whether it is upgrading an old system or starting an entirely new one, whether it is launching a data-utilization training program or simply searching for tips on how to use data in classroom instruction—the county can find relevant information through the statewide strategy and an accompanying online platform. The reality is that this knowledge already exists across Maryland, but it is not harnessed in an effective manner. The result is inefficiency, with counties often reinventing the wheel, or running into challenges that their colleagues and neighbors might have helped them to avoid.

A successful statewide strategy should strive to meet the needs of both state and county stakeholders. This would encourage stakeholders to engage with the strategy often because it provides direct value to their work. The MSDE could cultivate such value through incentives, such as grants or award and recognition programs, as well as cost-sharing or collaborative activities. An initial effort

should be made to reach out to stakeholders in each county to identify where they are with their own data system implementation and what needs they may have. Based on that feedback, the Department could arrange webinars, cross-county coaching and learning networks, and repositories of relevant documents.

In addition to providing direct value to each county, a statewide strategy should also outline the state's overarching vision and objectives for the system, bringing cohesion and alignment to statewide data system activities. Innovative interactive tools could even show how each county is contributing to statewide goals, similar to the way that the DQC tracks state progress toward ensuring effective data utilization.

Establishing Leadership and a Communication Mechanism

The success of a statewide data-system strategy would depend in part on leadership and communication. It is important that state and county decision makers would support the strategy, and that a committed group or steering committee be identified to carry the project forward. The steering committee should have stakeholders from across the education system, consisting of both state and county officials, and teachers and principals.

Communication plays a key part in developing buy-in. How stakeholders could support the strategy if they do not know about it, know what it intends to accomplish, or—most importantly—understand how it would benefit their day-to-day work? A simple communications campaign with steady, ongoing, updates, similar to Ohio Department of Education's EMIS Newsflash, would help make all stakeholders feel part of the process. As such, developing an online platform for the statewide strategy would be important. One option would be to carve out a space on an existing platform, such as marylandpublicschools.org or mdk12.org. Most importantly, the platform should be an online space that stakeholders are aware of and frequently visit. Finding ways to share updates through county websites, social media, e-mail, and other communication channels would be worth exploring. Perhaps the steering committee could circulate a questionnaire that asks stakeholders how they prefer to receive information.

Part of Maryland's strength rests in its decentralized structure, a characteristic that is embraced and defended at the county level. That said, it is important that decentralization and autonomy do not create siloes and walls that ultimately come at the expense of learning and efficiency. The purpose of a statewide EMIS strategy would be to prevent this from happening by supporting the MSDE in cultivating collaboration, shared goals, and alignment, while also celebrating Maryland's innovative and diverse counties.

CHAPTER 6

Continuing the Journey from Compliance to Learning

This report examined Maryland's ongoing journey from using data for compliance purposes toward using data for learning outcomes. This evolution is not linear, but instead consists of different iterations and policy reforms and an evolving mindset and culture, as well as strong leadership and a cadre of capable educators and administrators at all levels of the education system.

The state's success in establishing an enabling environment for education data systems and data utilization has built a strong foundation. Maryland effectively aligned a complex, statewide data system to deliver value. Prioritization of integration and alignment were key. The state then launched a longitudinal data system center that would drive an adaptive education system with insights that track students from pre-kindergarten into the workforce. Data across the state is high quality and follows strict rules to preserve privacy and security. Maryland's utilization of data also offers some valuable lessons. The statewide data system supports policy makers and decision makers in planning and management, as well as teachers, students, and families in instruction and learning. Consistent across Maryland's structuring and use of data systems were a strong vision and a road map to execute that vision.

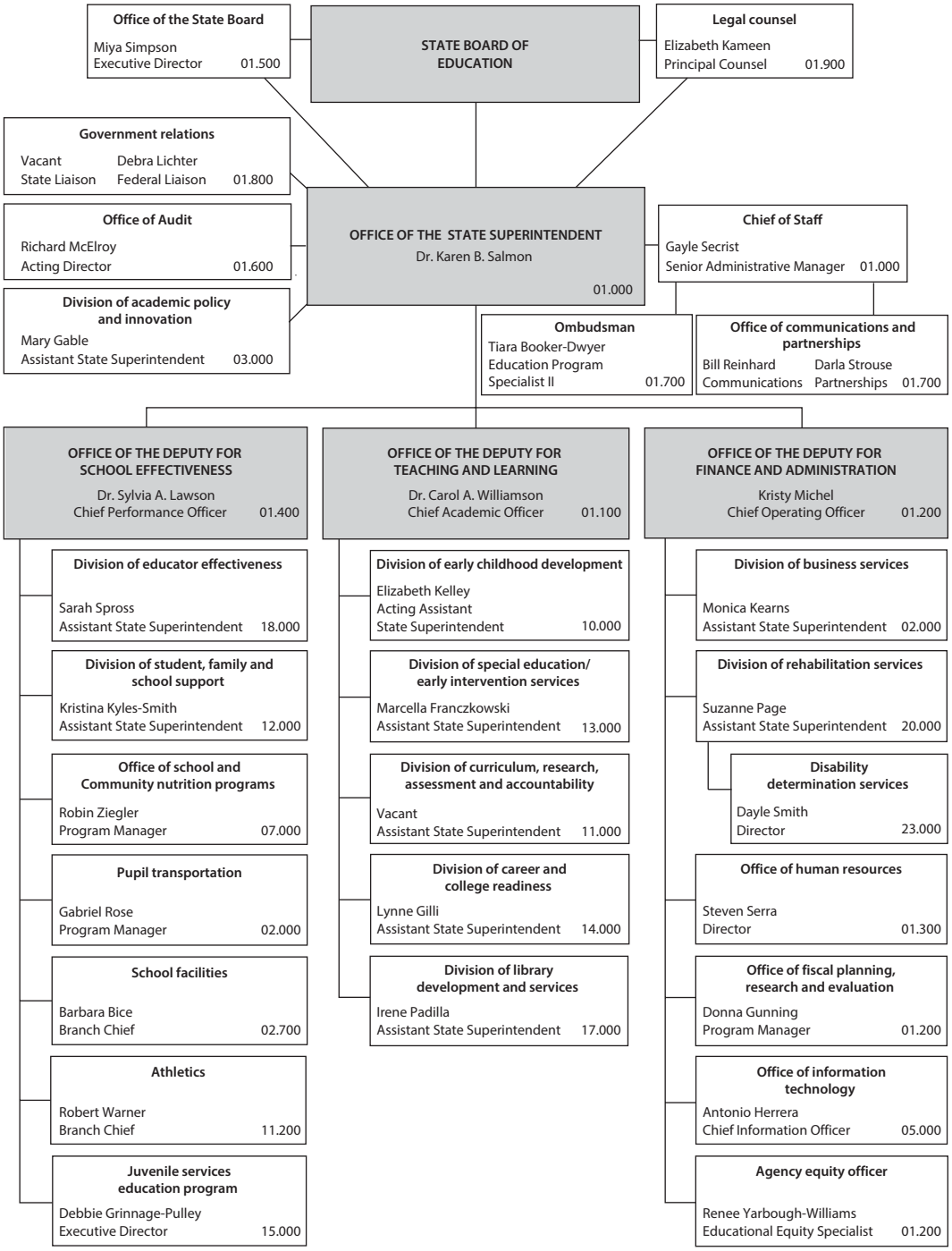
Maryland's journey offers many lessons, not only for countries with advanced data systems, but also for those in less-developed stages. While the technology and information exist to achieve data for learning, harnessing data within the right information system and ensuring utilization are challenging endeavors. An array of factors must align—leadership, policies, processes, and resources, to name a few—to effectively harness data in such a way that it supports and drives strong learning outcomes.

The state of Maryland is effectively using data to boost learning in numerous ways. Its achievements and success in this area are the result of a myriad factors coming together. It is a process that has proved challenging and time-consuming, but that also carries enormous potential for students.

APPENDIX A

Maryland State Department of Education Organizational Chart

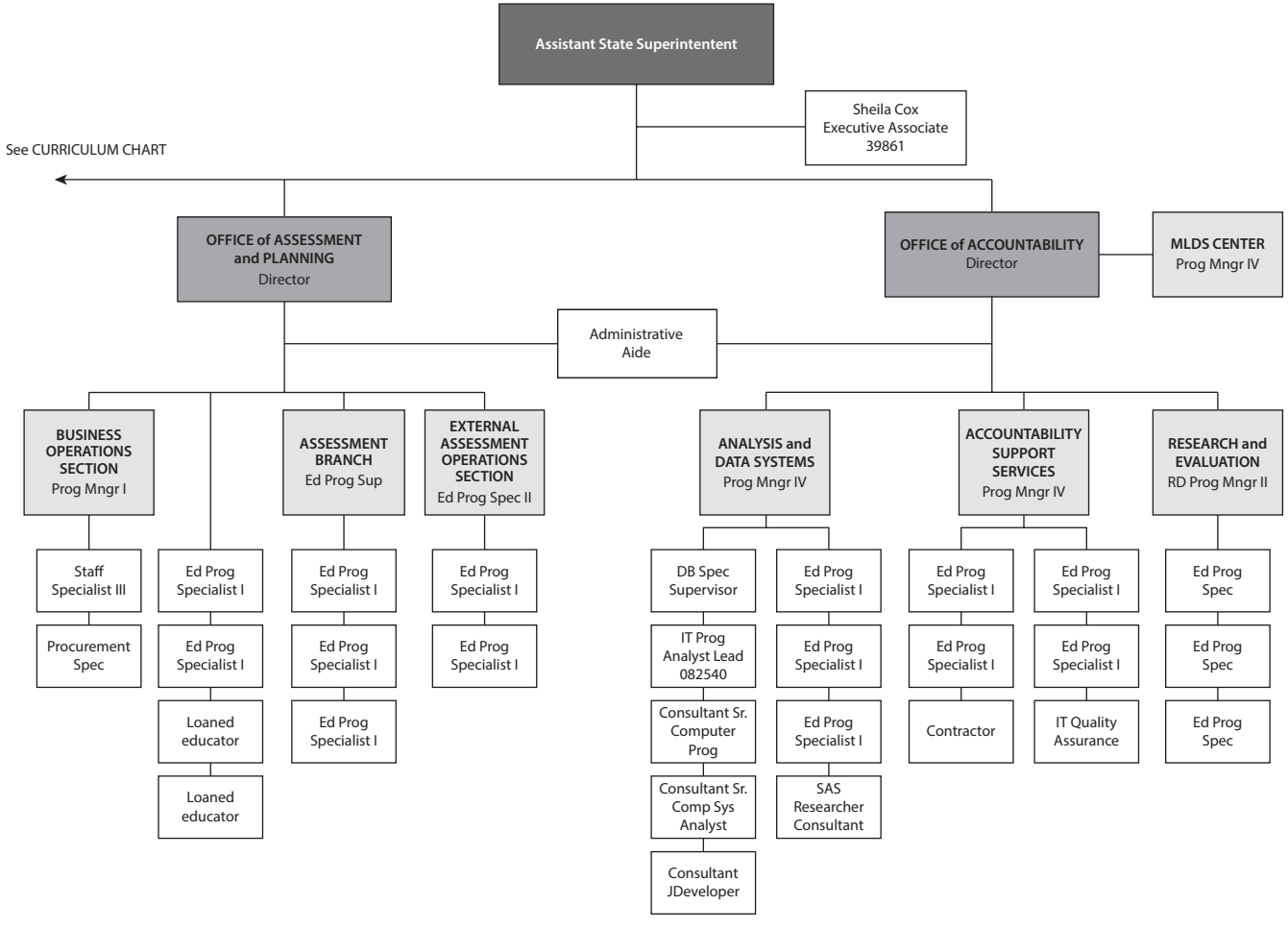
Figure A.1 Maryland State Department of Education Organizational Chart



APPENDIX B

Division of Curriculum, Assessment and Accountability Organizational Chart

Figure B.1 Division of Curriculum, Assessment and Accountability Organizational Chart



APPENDIX C

DQC's 10 State Actions to Ensure Effective Data Use, Maryland's 2014 Score

	STATE ACTION	State status	Number of states
1.	**Link state K-12 data systems with early learning, postsecondary, workforce, and other critical state agency data systems.**	**YES**	**19**
	K-12 and early childhood data are annually matched and shared with a known match rate.	Yes	43
	K-12 and postsecondary data are annually matched and shared with a known match rate.	Yes	43
	K-12 and workforce data are annually matched and shared with a known match rate.	Yes	19
2.	**Create stable, sustainable support for longitudinal data systems.**	**YES**	**41**
	The P-20/workforce state longitudinal data system (SLDS) is mandated, or data system use is required in state policy.	Yes	45
	The P-20/workforce SLDS receives state funding.	Yes	41
3.	**Develop governance structures to guide data collection and use.**	**YES**	**42**
	A state education agency data governance committee is established	Yes	45
	A cross-agency data governance committee/council is established with authority.	Yes	43
4.	**Build state data repositories.**	**YES**	**46**
	K-12 data repository is built and implemented.	Yes	46
5.	**Provide timely, role-based access to data.**	**NO**	**11**
	Multiple levels or types of role-based access are established.	Yes	42
	Parents, teachers, and appropriate stakeholders have access to student-level longitudinal data.	No	17
	Superintendents, state policymakers, or state education agency staff and other stakeholders have access to aggregate-level longitudinal data.	Yes	42
	State policy ensures that teachers and parents have access to their students' longitudinal data.	No	13
	The state is transparent about who is authorized to access specific data and for what purposes.	Yes	28
6.	**Create progress reports with student-level data for educators, students, and parents.**	**YES**	**35**
	The state produces reports using student-level longitudinal data.	Yes	42
	Teachers and appropriate stakeholders have tailored reports using student-level longitudinal data.	Yes	35

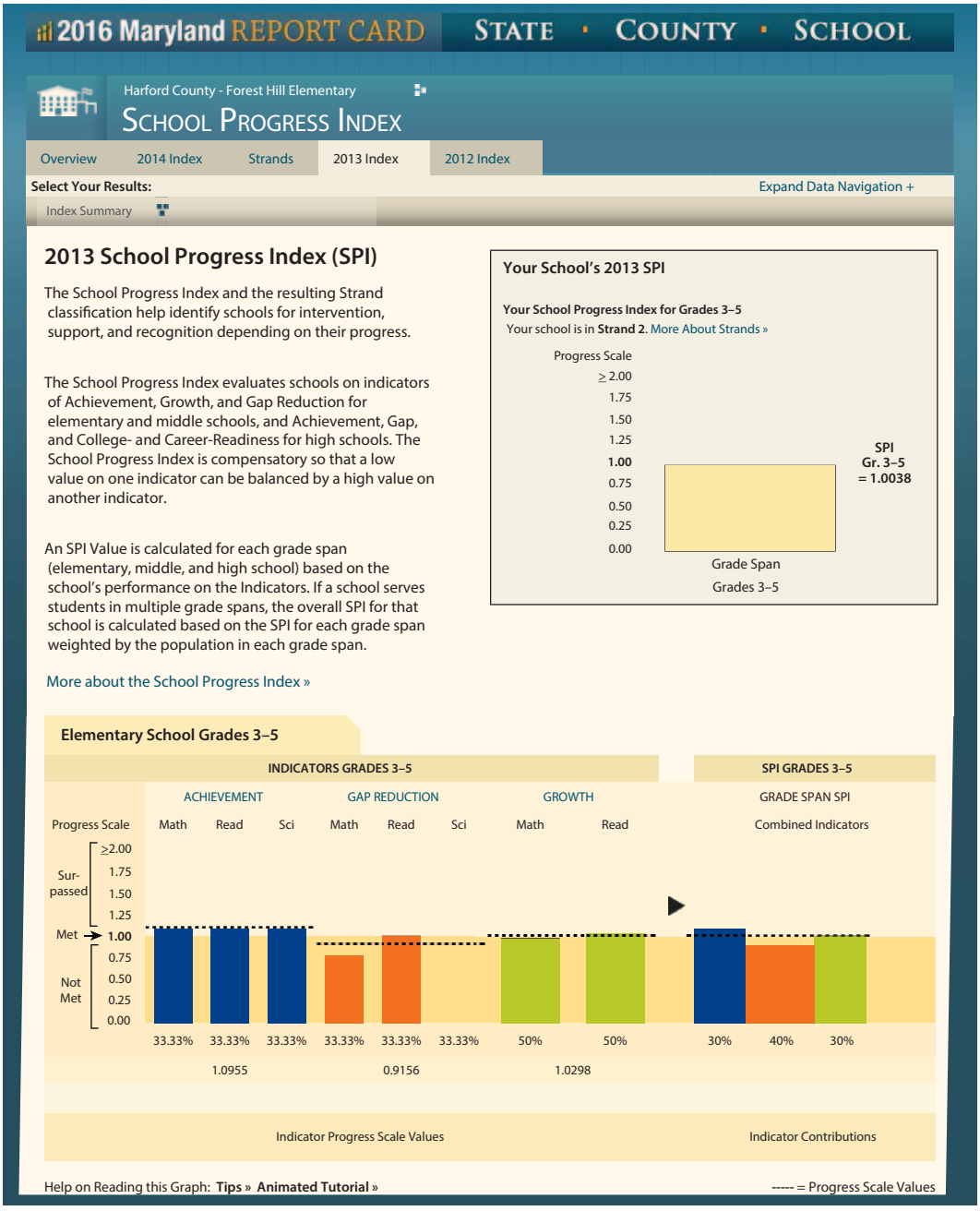
table continues next page

	STATE ACTION	State status	Number of states
7.	**Create reports with longitudinal statistics to guide system-level change.**	**YES**	**45**
	The state produces reports using aggregate-level longitudinal data.	Yes	46
	State-produced reports using aggregate-level longitudinal data are available on a state-owned public website.	Yes	45
8.	**Develop a purposeful research agenda.**	**YES**	**41**
	The state has developed a purposeful research agenda with other organizations.	Yes	43
	The state has a process by which outside researchers can propose their own studies.	Yes	45
9.	**Implement policies and promote practices to build educators' capacity to use data.**	**NO**	**18**
	Teachers and principals are trained to use longitudinal data to tailor instruction and inform schoolwide policies and practices.	No	40
	Teachers and principals are trained to use and interpret specific reports.	Yes	42
	The state plays an active role in training educators to use and interpret specific reports.	Yes	41
	Preservice: Data literacy is a requirement for certification/licensure, or data literacy training is a requirement for state program approval.	Yes	32
	Teacher performance data are automatically shared with in-state educator preparation programs at least annually.	Yes	22
10.	**Promote strategies to raise awareness of available data.**	**YES**	**33**
	The state communicates the availability of data to noneducator stakeholders.	Yes	43
	The state trains noneducator stakeholders on how to use and interpret data.	Yes	34
	The state education agency makes data privacy and security policies public.	Yes	46

APPENDIX D

Maryland School Progress Index, Forest Hill Elementary

Figure D.1 Maryland School Progress Index, Forest Hill Elementary



APPENDIX E

My School Australia, Profile for Gordon East Public School

Figure E.1 My School Australia, Profile for Gordon East Public School

Gordon East Public School, Gordon, NSW

School comments

Gordon East Public School is a high performing school situated on spacious, picturesque grounds in Gordon. An outstanding feature of our school is the sense of shared purpose by the school community and the supportive relationships that underpin this. We value high expectations for student learning, enabling all students to strive for and experience success. Highly professional and dedicated teachers implement quality learning programs across all key learning areas. Gordon East provides innovative and well-resourced programs that engage, motivate and inspire students to achieve excellence. Students participate in a variety of opportunities including robotics, chess club, Maths Olympiad, representative sport, string ensembles, bands, choirs and dance groups.

2008 | 2009 | 2010 | 2011 | 2012 | **2013** | 2014 | 2015

School facts

School sector	Government
School type	Primary
Year range	K-6
Location	Metropolitan

School staff

Teaching staff	16
Full-time equivalent teaching staff	18
Non-teaching staff	4
Full-time equivalent non-teaching staff	2.8

Links

School website	Gordon East Public School
Sector, system or association website	Department of Education NSW

Student background

Index of Community Socio-Educational Advantage (ICSEA)

School ICSEA value	1195
Average ICSEA value	1000
Data source	Parent information

Distribution of students [2]

	Bottom quarter	Middle quarters		Top quarter
School Distribution	1%	3%	14%	83%
Australian Distribution	25%	25%	25%	25%

Percentages are rounded and may not add to 100

Students

Total enrolments	359
Girls	181
Boys	178
Full-time equivalent enrolments	359
Indigenous students	0%
Language background other than English	25%
Student attendance rate	96%

APPENDIX F

Summary of Policy Lever Benchmarking for the State of Maryland

Table F.1 Summary of Policy Lever Benchmarking for the State of Maryland

Policy goal	*Policy lever*	*Score*	*Weight (%)*	*Benchmark*
Enabling environment	Legal framework	3.66	15	Advanced
	Organizational structure and institutionalized processes	4.00	15	Advanced
	Human resources	3.83	15	Advanced
	Infrastructural capacity	3.83	15	Advanced
	Budget	4.00	15	Advanced
	Data-driven culture	3.43	10	Advanced
System soundness	Data architecture	3.69	20	Advanced
	Data coverage	2.45	30	Established
	Data analytics	2.67	15	Established
	Dynamic system	2.84	15	Established
	Serviceability	2.73	20	Established
Quality data	Methodological soundness	3.78	25	Advanced
	Accuracy and reliability	3.55	25	Advanced
	Integrity	3.66	25	Advanced
	Periodicity and timeliness	4.00	25	Advanced
Utilization in decision making	Openness	2.62	15	Established
	Operational use	3.03	50	Advanced
	Accessibility	3.52	20	Advanced
	Effectiveness in disseminating findings	2.20	15	Established

APPENDIX G

Rubric to Benchmark EMIS in Maryland

Table G.1 Rubric to Benchmark EMIS in Maryland

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
Policy area 1: Enabling environment		**The system contains crucial components of a comprehensive enabling environment, which addresses related policy elements and enables the functioning of an effective and dynamic system.**	**The system lacks major components of a comprehensive enabling environment.**	**The system contains basic components of a comprehensive enabling environment.**	**The system contains most components of a comprehensive enabling environment.**	**The system contains crucial components of a comprehensive enabling environment.**
1.1 Legal framework	Institutionalization of system: the EMIS is institutionalized as an integral part of the education system and the government.	An existing legal framework supports a fully functioning EMIS.	A legal framework is not in place.	Basic components of a legal framework or informal mechanisms are in place.	Most elements of a legal framework are in place.	An existing legal framework supports a fully functioning EMIS.
	Responsibility: Responsibility for collecting, processing, and disseminating education statistics is given to a clearly designated institution or agency.					

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
	Dynamic framework: The legal framework is dynamic and elastic so that it can adapt to advancements in technology.					
	Data supply: The legal framework mandates that schools participate in the EMIS by providing education data.					
	Comprehensive, quality data: The requirement for comprehensive, quality data is clearly specified in the EMIS legal framework.					
	Data sharing and coordination: The legal framework allows for adequate data sharing and coordination among the Ministry of Education and agencies and institutions that require education data.					

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
	Utilization: The legal framework emphasizes data-driven education policy.					
	Budget: The education system budget includes a line item for the EMIS.					
	Confidentiality: The legal framework guarantees that respondents' data are confidential and used for the sole purpose of statistics.					
1.2 Organizational structure and institutionalized processes	Organizational structure and institutionalized processes are in place.	The system is institutionalized within the government, has well-defined organizational processes, and has several functionalities beyond statistical reporting.	The system is not specified in policies, and what exists does not have well-defined organizational processes; the EMIS has limited functionalities.	The institutional structure of the system is not clearly specified in policies, it has some organizational processes, and its functionalities are limited.	The institutional structure of the system is defined within the government, and it has defined organizational processes, but its functionalities are limited.	The system is institutionalized within the government, has well-defined organizational processes, and has several functionalities beyond statistical reporting.

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
1.3 Human resources	Personnel: The core tasks of the EMIS are identified, and it is staffed with qualified people.	Qualified staff operate the system, and opportunities are available to improve staff performance and retention.	Minimum standards of qualification are not met for the majority of staff that operate the system, and opportunities are not available to improve staff performance or retention.	Some staff are qualified to operate the system, and limited opportunities are available to improve staff performance and retention.	The majority of staff are qualified to operate the system, and frequent opportunities are available to improve staff performance and retention.	All staff are qualified to operate the system, and well-established opportunities are constantly available to improve staff performance and retention.
	Professional development: Professional training is available for EMIS staff.					
1.4 Infrastructural capacity	Data collection: Tools for data collection are available	The system has a well-defined infrastructure to perform data collection, management, and dissemination functions in an integral manner	The system lacks a well-defined infrastructure.	The system has a basic or incomplete infrastructure.	The system has an infrastructure that allows it to perform some of its functions in an integral manner.	The system has a well-defined infrastructure to fully perform its data collection, management, and dissemination functions in an integral manner.
	Database(s): Databases exist under the umbrella of the data warehouse and have both hardware and software means.					

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
	Data management system: A system is in place that manages data collection, processing, and reporting.					
	Data dissemination: Data dissemination tools are available and maintained by the agency producing education statistics.					
1.5 Budget	Personnel and professional development: The EMIS budget contains a specific budget for EMIS personnel and their professional development.	The system budget is comprehensive, ensuring that the system is sustainable and efficient.	The system suffers from serious budgetary issues.	The system has a basic or incomplete budget.	The system budget contains the majority of required categories to ensure that most parts of the system are sustainable and efficient.	The system budget is comprehensive, ensuring that the system is sustainable and efficient.
	Maintenance: The EMIS budget contains a specific budget for system maintenance and recurrent costs.					
	Reporting: The EMIS budget contains a specific budget for reporting costs.					

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
	Physical infrastructure: The EMIS budget contains a specific budget for physical infrastructure costs.					
	Efficient use of resources: Processes and procedures are in place to ensure that resources are used efficiently.					
1.6 Data-driven culture	Data-driven culture	A data-driven culture prioritizes data as a fundamental element of operations and decision making, both inside and outside of the education system.	The system suffers because there is not a data-driven culture that prioritizes data management and data utilization in decision making.	The system has a data-driven culture that demonstrates a basic appreciation of data and interest in developing better data-utilization practices.	A data-driven culture exists that prioritizes data management and utilization within and beyond the education system.	A data-driven culture exists that prioritizes data management and utilization within and beyond the education system, and evidence of that culture is present in daily interaction and decision making at all levels.

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
Policy area 2: System soundness		**The processes and structure of the EMIS are sound and support the components of an integrated system.**	**The system lacks processes and structure.**	**The system has basic processes and a structure that do not support the components of an integrated system.**	**The system has some processes and a structure, but they do not fully support the components of an integrated system.**	**The processes and structure of the system are sound and support the components of an integrated system.**
2.1 Data architecture	Data architecture	The data architecture is well defined to ensure full system functionality.	The system's data structure does not have a well-defined data architecture.	The system's data architecture includes some components; however, it is incomplete.	The system's data structure has most elements of the data architecture; however, it has some deficiencies that affect the system's functionality.	The data architecture is well defined to ensure full system functionality.
2.2 Data coverage	Administrative data: the EMIS contains administrative data.	The data in the system are comprehensive and cover administrative, financial, human resources, and learning-outcomes data.	The data in the system are far from being comprehensive, and coverage is limited.	The data in the system include some of the data areas.	The data in the system include most, but not all, of the data areas.	The data in the system are comprehensive and cover all data areas.
	Financial data: the EMIS contains financial data.					
	Human resources data: the EMIS contains human resources data.					

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
	Learning-outcomes data: the EMIS contains learning-outcomes data.					
2.3 Data analytics	Data analytics	Tools and processes are available to perform data analytics at different levels on a regular basis.	Tools and processes are available to perform limited tabulations.	Basic tools and processes are available, but the system is not capable of conducting advanced analytical steps (e.g., predictive models, projections).	Tools and processes are available; however, data analytics are not performed regularly.	Tools and processes are available to perform data analytics at different levels on a regular basis.
2.4 Dynamic system	Quality-assurance measures: The system is dynamic and maintains quality-assurance measures.	The system in place is elastic and easily adaptable to allow for changes and advancements in data needs.	The system in place is not easily adaptable to changes and advancements in data needs, because no quality-assurance standards are used.	The system in place is not easily adaptable and requires significant time and resources to accommodate changes or advancements.	The system in place is easily adaptable, but it remains reasonably complex.	The system in place is elastic and easily adaptable to allow for changes and advancements in data needs.
	Data requirements and considerations: Mechanisms are in place for addressing new and emerging data requirements.					

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
	System adaptability: the EMIS is elastic and easily adaptable to allow for changes and advancements in data needs.					
2.5 Serviceability	Validity across data sources: Information brought together from different data or statistical frameworks in the EMIS is placed within the data warehouse using structural and consistency measures.	Services provided by the system are valid across data sources; integrate noneducation databases into the EMIS; and archive data at the service of EMIS clients by ensuring the relevance, consistency, usefulness, and timeliness of its statistics	Serious issues exist related to data validity and consistency.	Inconsistencies exist related to data validity and consistency.	The data are consistent and valid; however, some concerns exist.	Services provided by the system are valid across data sources, integrate noneducation databases into the EMIS, and archive data at the service of EMIS clients by ensuring the relevance, consistency, usefulness, and timeliness of its statistics.
	Integration of noneducation databases into the EMIS: Data from sources collected by agencies outside of the EMIS are integrated into the EMIS data warehouse.					

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
	Archiving data: Multiple years of data are archived, including source data, metadata, and statistical results.					
	Services to EMIS clients: Services provided by the system to EMIS clients include ensuring the relevance, consistency, usefulness, and timeliness of its statistics.					
Policy area 3: Quality data		**The system has the mechanisms required to collect, save, produce, and utilize information, which ensures accuracy, security, and timely, high-quality information for use in decision making.**	**The system lacks mechanisms to collect, save, or produce timely, high-quality information for decision making.**	**The system has basic mechanisms to collect, save, and produce timely, quality information; however, its accuracy might be questionable.**	**The system has most mechanisms in place needed to collect, save, and produce timely, high-quality information for use in decision making; however, some additional measures are needed to ensure accuracy, security, and timely information that can be used for decision making.**	**The system has the required mechanisms in place to collect, save, produce, and utilize information, which ensures accuracy, security, and timely, high-quality information for use in decision making.**

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
3.1 Methodological soundness	Concepts and definitions: Data fields, records, concepts, indicators, and metadata are defined and documented in official operations manuals along with other national datasets and endorsed by the government. Classification: There are defined education system classifications based on technical guidelines and manuals. Scope: The scope of education statistics is broader than, and not limited to, a small number of indicators (e.g., measurements of enrollment, class size, completion).	The methodological basis for producing educational statistics from raw data follows internationally accepted standards, guidelines, and good practices.	The methodological basis for producing educational statistics does not follow internationally accepted standards, guidelines, or good practices.	The methodological basis for producing educational statistics follows the basics of internationally accepted standards, guidelines, and good practices.	The methodological basis for producing educational statistics follows most required internationally accepted standards, guidelines, and good practices.	The methodological basis for producing educational statistics from raw data follows internationally accepted standards, guidelines, and good practices.

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
	Basis for recording: Data-recording systems follow internationally accepted standards, guidelines, and good practices.					
3.2 Accuracy and reliability	Source data: Available source data provide an adequate basis for compiling statistics.	Source data and statistical techniques are sound and reliable, and statistical outputs sufficiently portray reality.	Source data and statistical techniques lack soundness and reliability.	Source data and statistical techniques have basic soundness and reliability, but statistical outputs do not portray reality.	Source data and statistical techniques follow most required elements to be sound and reliable, but statistical outputs do not portray reality.	Source data and statistical techniques are sound and reliable, and statistical outputs sufficiently portray reality.
	Validation of source data: Source data are consistent with the definition, scope, and classification, as well as time of recording, reference periods, and valuation of education statistics.					
	Statistical techniques: Statistical techniques are used to calculate accurate rates and derived indicators.					

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
3.3 Integrity	Professionalism: EMIS staff exercise their profession with technical independence and without outside interference that could result in the violation of the public trust in EMIS statistics and the EMIS itself. Transparency: Statistical policies and practices are transparent. Ethical standards: Policies and practices in education statistics are guided by ethical standards.	Education statistics contained within the system are guided by principles of integrity.	Education statistics contained within system are not guided by principles of integrity.	Education statistics contained within the system are guided by limited principles of integrity (one of the three principles of professionalism, transparency, and ethical standards).	Education statistics contained within the system are mostly guided by principles of integrity (two of the three principles of professionalism, transparency, and ethical standards).	Education statistics contained within the system are guided by all three principles of integrity: professionalism, transparency, and ethical standards.
3.4 Periodicity and timeliness	Periodicity: The production of reports and other outputs from the data warehouse occur in accordance with cycles in the education system. Timeliness: Both final statistics and financial statistics are disseminated in a timely manner.	The system produces data and statistics periodically in a timely manner	The system produces data and statistics neither periodically nor in a timely manner.	The system produces some data and statistics periodically and in a timely manner.	The system produces most data and statistics periodically and in a timely manner.	The system produces all data and statistics periodically and in a timely manner.

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
Policy area 4: Utilization for decision making		**The system is wholly utilized by different users for decision making at different levels of the education system.**	**There are no signs that the EMIS is utilized in decision making by the majority of education stakeholders.**	**The system is used by some education stakeholders, but not for major policy decision making.**	**The system is used by most education stakeholders but is not fully operational in governmental decision making.**	**The system is wholly utilized by different users for decision making at different levels of the education system.**
4.1 Openness	EMIS stakeholders: EMIS primary stakeholders are identified and use the system in accordance with the legal framework.	The system is open to education stakeholders in terms of their awareness and capacity to utilize the system.	The system lacks openness to education stakeholders in terms of their awareness and capacity to utilize the system.	The system is open to some education stakeholders in terms of their awareness and capacity to utilize the system.	The system is open to the majority of education stakeholders in terms of their awareness and capacity to utilize the system.	The system is open to all education stakeholders in terms of their awareness and capacity to utilize the system.
	User awareness: Current and potential EMIS users are aware of the EMIS and its outputs.					
	User capacity: EMIS users have the skills to interpret, manipulate, and utilize the data produced by the system to ultimately disseminate findings.					

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
4.2 Operational use	Utilization in evaluation: Data produced by the EMIS are used to assess the education system.	Data produced by the system are used in practice by the main education stakeholders.	Data produced by the system are not used in practice by education stakeholders.	Data produced by the system are used in practice by some education stakeholders.	Data produced by the system are used in practice by the majority of education stakeholders.	Data produced by the system are used in practice by the main education stakeholders.
	Utilization in governance: Data produced by the EMIS are used for governance purposes.					
	Utilization by schools: Data produced by the EMIS are used by schools.					
	Utilization by clients: Data produced by the EMIS are used by clients (including parents, communities, and other actors).					
	Utilization by government: The system is able to produce summative indicators (derived variables) to monitor the education system.					

table continues next page

Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
4.3 Accessibility	Understandable data: Data are presented in a manner that is easily digestible.	Education statistics are presented in an understandable manner and are widely disseminated using clear platforms for utilization; assistance is available to users.	The system suffers from serious accessibility issues.	The system has major accessibility issues.	The system has minor accessibility issues.	Education statistics are presented in an understandable manner and are widely disseminated using a clear platform for utilization; assistance is available to users.
	Widely disseminated data: Education statistics are disseminated beyond the Ministry of Education and education statistics-producing agency to other EMIS stakeholders.					
	Platforms for utilization: Platforms are standardized across the EMIS and are customizable to user needs.					

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Table G.1 Rubric to Benchmark EMIS in Maryland *(continued)*

Policy levers	*Indicators*	*Description of best practices*	*Scoring*			
			Latent	*Emerging*	*Established*	*Advanced*
	User support: Assistance is available to EMIS users upon request to help them access the data.					
4.4 Effectiveness in disseminating findings	Dissemination strategy: The national government has an information-dissemination strategy in place.	Dissemination of education statistics via an EMIS is strategic and effective.	Dissemination is neither strategic nor effective.	Dissemination is reasonably strategic, but ineffective.	A dissemination plan has been implemented; however, room exists for improvement (for full effectiveness in relation to strategic engagement).	The dissemination of education statistics via an EMIS is strategic and effective.
	Dissemination effectiveness: Dissemination of EMIS statistics is effective.					

Note: Maryland scores are shaded.

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From Compliance to Learning • http://dx.doi.org/10.1596/978-1-4648-1058-9

From Compliance to Learning: A System for Harnessing the Power of Data in the State of Maryland builds on a 2015 World Bank report that assessed Education Management Information Systems (EMISs) in the state of Maryland. That report uncovered a successful system, and this one expands on lessons learned and ways to apply them in practice. The goal of this study is to distill Maryland's good practices in education data systems and share them in a way that is useful to education stakeholders interested in harnessing the power of data to strengthen learning outcomes. This study also examines the history of education data collection and use in the United States with a focus on Maryland, including a review of federal and state legislation that has helped to shape Maryland's education data policies and systems.

In the digital age, information is power. When information is effectively harnessed and aligned with student learning, it carries the potential to radically transform the delivery of education, as well as the sector as a whole. Increasingly, education systems are moving away from using education data narrowly for compliance purposes; instead, they are embracing data as a tool to drive systemwide innovation, professionalization, and, most importantly, learning. Whether to prioritize and optimize data and information systems around student learning is no longer an option; it is imperative for education systems that aim to excel and achieve strong learning outcomes. Over the past several decades, fundamental shifts have occurred in the way that education data are collected, managed, and used. Today real-time learning data inform classroom instruction; predictive analytics identify at-risk youth before they drop out of school; and data from preschool to workforce are linked to help guide education reforms. These represent just a few of the innovative ways that schools and other stakeholders across the United States are harnessing data to improve education.

The state's success in establishing an enabling environment for education data systems and data utilization has built a strong foundation. Maryland effectively aligned a complex, statewide data system to deliver value. Prioritization of integration and alignment was key. The state then launched a longitudinal data system center that would drive an adaptive education system with insights that track students from pre-kindergarten to entry in the workforce. Data across the state are high quality and follow strict rules to preserve privacy and enhance security. Maryland's utilization of data also offers valuable lessons. The statewide data system supports policy makers and decision makers in planning and management, as well as teachers, students, and families in instruction and learning. Consistent across Maryland's structuring and use of data systems were a strong vision and a road map to execute that vision.

Maryland's journey offers many lessons, not only for countries with advanced data systems but also for those in less developed stages. While the technology and information exist to achieve data for learning, harnessing data within the right information system and ensuring utilization are challenging endeavors. An array of factors must align—leadership, policies, processes, and resources, to name a few—to effectively harness data to support and drive strong learning outcomes.

ISBN 978-1-4648-1058-9

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SKU 211058

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