

DATA FOR EDUCATION

A Guide for Policymakers to
Leverage Education Data



unesco

Institute for Statistics

UNESCO

The constitution of the United Nations Educational, Scientific and Cultural Organization (UNESCO) was adopted by 20 countries at the London Conference in November 1945 and entered into effect on 4 November 1946.

The main objective of UNESCO is to contribute to peace and security in the world by promoting collaboration among nations through education, science, culture and communication in order to foster universal respect for justice, the rule of law, and the human rights and fundamental freedoms that are affirmed for the peoples of the world, without distinction of race, sex, language or religion, by the Charter of the United Nations.

To fulfil its mandate, UNESCO performs five principal functions: 1) prospective studies on education, science, culture and communication for tomorrow's world; 2) the advancement, transfer and sharing of knowledge through research, training and teaching activities; 3) standard-setting actions for the preparation and adoption of internal instruments and statutory recommendations; 4) expertise through technical cooperation to Member States for their development policies and projects; and 5) the exchange of specialized information.

UNESCO Institute for Statistics

The UNESCO Institute for Statistics (UIS) is the statistical office of UNESCO and is the UN depository for global statistics in the fields of education, science, technology and innovation, culture and communication. The UIS was established in 1999. It was created to improve UNESCO's statistical programme and to develop and deliver the timely, accurate and policy-relevant statistics needed in today's increasingly complex and rapidly changing social, political and economic environments.

Acknowledgements

This publication is the result of a collaborative effort produced under the overall coordination and guidance of the UIS Director Dr. Silvia Montoya. We would like to thank the team formed by consultants who supported the research and design (Giselle Del Carmen, Massiel Valladares, Ananya Chaudhuri) and the dedicated team at the UNESCO Institute for Statistics (Roshan Bajracharya, Adolfo Imhof, and Lina Ktaili).

This publication is based on research funded by contributions from the Governments of Canada, Great Britain, Norway, and Sweden that support the UIS core education work. The findings and conclusions contained within are those of the authors and do not necessarily reflect positions or policies of either UNESCO or the donors.

Published in 2023 by:

UNESCO Institute for Statistics
C.P. 250 Succursale H
Montreal, Quebec H3G 2K8
Canada
<http://www.uis.unesco.org>

ISBN: 978-92-9189-326-3
Ref: UIS/2023/ED/SD/7

© UNESCO-UIS 2023



This publication is available in Open Access under the Attribution-ShareAlike 3.0 IGO (CC-BY-SA 3.0 IGO) license (<http://creativecommons.org/licenses/by-sa/3.0/igo/>). By using the content of this publication, the users accept to be bound by the terms of use of the UNESCO Open Access Repository (<http://www.unesco.org/open-access/terms-use-cbysa-en>).

The designations employed and the presentation of material throughout this publication do not imply the expression of any opinion whatsoever on the part of UNESCO concerning the legal status of any country, territory, city or area or of its authorities or concerning the delimitation of its frontiers or boundaries.

Table of Contents

FIGURES	4
ACRONYMS	5
LEVERAGING THE EDUCATION DATA ECOSYSTEM: INTRODUCTION	7
ADMINISTRATIVE DATA	11
What is administrative data?	11
Who is responsible?.	13
Why is it relevant for education policy planning and SDG4 monitoring?	13
FINANCIAL AND EXPENDITURE DATA	15
What is financial and expenditure data?	15
Who is responsible?.	15
Why is it relevant for education policy planning and SDG4 monitoring?	16
HOUSEHOLD SURVEYS AND POPULATION CENSUSES	17
What are household surveys and population censuses?	17
Who conducts household surveys and population censuses?.	18
Why are they relevant for education policy planning and SDG4 monitoring?	18
LEARNING ASSESSMENTS	21
What are learning assessments?	21
Who conducts learning assessments?	21
Why are they relevant for education policy planning and SDG4 monitoring?	22
COMBINING DATA SOURCES: VALUE-ADDED ANALYSIS	25
QUALITY DATA: RELEVANCE, COMPARABILITY, ACCESS	27
Relevance	27
Comparability	28
Access	28
POTENTIAL BOTTLENECKS AND SOLUTIONS	31
Bottlenecks	31
Potential Solutions	33
FIT-FOR-PURPOSE DATA ECOSYSTEMS	37
REFERENCES	39

Figures

Figure 1. Vicious Education Data Cycle	9
Figure 2. Education Data Ecosystem	10
Figure 3. Sources of education data.	11
Figure 4. Sources of education data.	13
Figure 5. Financial & expenditure data	17
Figure 6. Survey & Population Census education data	19
Figure 7. Learning assessment measures student’s learning and skills.	23
Figure 8. A comprehensive view of Education Data Sources	26
Figure 9. Combining Education Data Sources to better policy solutions	28
Figure 10. Data Quality Checklist	32
Figure 11. Pros and Cons of Technology vs. Paper Data Collection	35
Figure 12. Potential Bottlenecks and Solutions	37
Figure 13. From a vicious cycle to a virtuous Education Data Cycle	39

Acronyms

AMPL	Assessment for Minimum Proficiency Levels
CPF	<i>Cadastro Geral de Pessoa Física</i> (Brazil)
DHIS2	District Health Information Software
EMIS	Educational Management Information System(s)
ERCE	UNESCO's Regional Comparative and Explanatory Study
FEMIS	Fiji Education Management Information System
GAML	Global Alliance to Monitor Learning
GPF	Global Proficiency Framework
ID	Identifier
ISCED	International Standard Classification of Education
ISCED-T	International Standard Classification of Teacher Training Programmes
LANA	Literacy and Numeracy Assessment
LSMS	Living Standards Measurement Study
MEMIS	Maldives Education Management Information System
MoBSE	Ministry of Basic and Secondary Education
MoE	Ministry of Education
MPLs	Minimum Proficiency Levels
NSO	National Statistics Offices
OECD	Organisation for Economic Cooperation and Development
PISA	Programme for International Student Assessment
SDGs	Sustainable Development Goals
SRC	School Report Card
TCG	Technical Cooperation Group on the Indicators for SDG4 - Education 2030
TIMSS	Trends in International Mathematics and Science Study
UIS	UNESCO Institute for Statistics
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural
UNICEF	Organization United Nations Children's Fund

Leveraging The Education Data Ecosystem: Introduction

Data is a key building block and pivotal input that shapes the formulation and implementation of effective education policy. It is embedded throughout the education policymaking journey, allowing policymakers to navigate the complex landscape of decision-making, budget and policy formulation, resource allocation, and monitoring and evaluation in a systematic, evidence-based manner. Without data, policies lack evidence to inform adequate decision-making and may fall short in addressing the complex challenges of the education sector. Moreover, in order to effectively monitor education policies, the data produced should be relevant, comparable, and accessible.

In low-income countries, producing education data might be costly in terms of human and financial resources and policymakers may not see the value in allocating these resources towards data production, resulting in insufficient support for education data systems. This can lead to a vicious cycle (Figure 1) where poor support leads to poor-quality data, and poor-quality data results in weak support (Gustaffson, 2019). Unclear and erroneous assumptions about the origin of education data exacerbate this vicious cycle: government officials may place trust in data from international organizations such as UNESCO Institute for Statistics (UIS) and the World Bank, without realizing that these organizations rely on their own country's National Statistics Offices (NSO) or Ministries of Education (MoE) as their primary source of information. This suggests that NSOs and/or MoE may lack the necessary skills to analyze and communicate data effectively – or even coordinate amongst themselves – hindering policymakers' ability to trust and comprehend it easily.

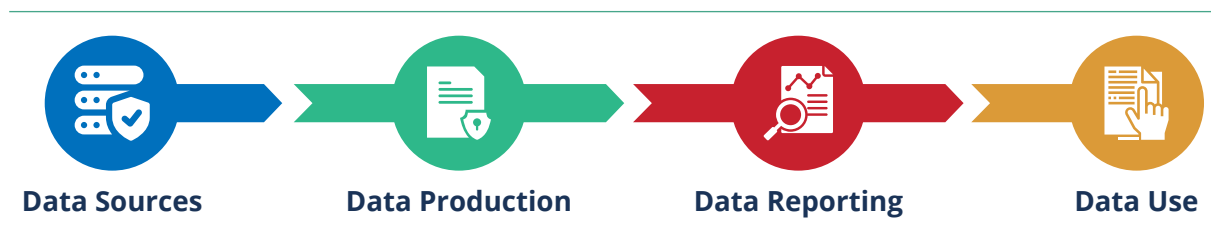
Figure 1. Vicious Education Data Cycle



Effectively leveraging the Education Data Ecosystem is fundamental to arrive at a sustainable education model that fulfils both specific ministry's goals and Sustainable Development Goal (SDG) 4, which aims to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”. Even though data is embedded throughout the education planning

journey, policymakers are often unaware of the fundamental data needed in the education sector (*Data Sources*), including how it should be collected, who collects it and how often it is collected (*Data Production*). Moreover, data must also be relevant, accessible, and comparable for national and international education progress monitoring (*Data Reporting*). Consequently, they may not understand how this data can inform policy design and innovations, contribute to efficient resource allocation, and ultimately improve learning outcomes (*Data Use*) (Figure 2). Adequate implementation of each component of the Education Data Ecosystem influences data quality.

Figure 2. Education Data Ecosystem



The value and know-how regarding how data systems should connect might also remain **unexplored**. The ability to combine data sources and/or link different databases using a *common identifier* is essential to provide value-added analysis. It is only through these iterations that end-users, including policymakers, can fully appreciate the substantial value that data can provide to address major challenges in the education sector.

Large development targets like the SDGs are tracked and met by reporting on and monitoring country-level data. The set of indicators that comprise the SDGs are the bedrock of the 2030 Agenda, and these rely on cross-country comparable data reporting from countries who set their own national benchmarks. In this way, countries determine their own contribution toward the achievement of SDG 4-Education based on their context, starting point, and ambition, leveraging other countries' benchmarks to measure their own progress. This is why it's imperative for countries' contributions to align with their national and regional education agendas.

The objective of this document is for policymakers to understand what data sources are available and the importance of producing high-quality data for effective policy planning. Education practitioners must understand the importance of investing in data and take advantage of *all* the data ecosystem- not just the resources available in the Ministry of Education- in order to create a cycle of increased investment in data collection, better quality data production, and better data-driven policies.

This document has four main sections, each outlining key sources of education data: administrative data, financial and expenditure data, household surveys and population censuses, and learning assessments (Figure 3). Identifying the distinct sources of data is a prerequisite for education stakeholders to leverage this data effectively. Each section includes:

- What each data source is and what kind of information it provides.
- Who is responsible for collecting the data.
- Why this data is important for education policy and SDG4 monitoring.

Figure 3. Sources of education data



**ADMINISTRATIVE
RECORDS**



**LEARNING
ASSESSMENTS**



**FINANCIAL &
EXPENDITURE**



**SURVEYS & POPULATION
CENSUSES**

The following sections delve into (i) combining data sources for value-added analysis, including linking data via a common identifier; and (ii) the importance of producing quality data that is relevant, comparable, and accessible.

The document also identifies common bottlenecks for effective data policy planning, such as shortage of skilled human capital, limited resources, and poor communication between different stakeholders. Furthermore, it outlines potential solutions and available resources from organizations like the UIS to help education practitioners and policymakers report internationally-comparable data, build capabilities, and obtain methodological guidance.

The final section describes sustainability of 'fit-for-purpose' education data ecosystem, through an understanding of the specific context, challenges, and priorities of each country.

Administrative Data

KEY TAKEAWAYS

- Administrative data includes information on schools, teachers and students.
- Most of this information is available through an Educational Management Information System (EMIS) managed by Ministries of Education.
- Over a third of SDG4 indicators are measured using administrative data.

What is administrative data?

Administrative data encompass supply-side information on the education sector: schools, teachers and students. It typically includes data on student enrollment, attendance, student dropout and repetition rates, student demographics, teacher demographics, teacher qualifications, school infrastructure, school location among others (Figure 4).

Figure 4. Sources of education data



ADMINISTRATIVE RECORDS

Schools

- ✓ Infrastructure
- ✓ Location
- ✓ Schools materials
- ✓ Type (public/private/NGO)

Teachers

- ✓ Number of teachers
- ✓ Gender
- ✓ Age
- ✓ Qualifications
- ✓ Teacher attendance
- ✓ Teaching grade level

Students

- ✓ Number of teachers
- ✓ Gender
- ✓ Age
- ✓ Grade level
- ✓ Attendance

Most of this information is available through an Educational Management Information System (EMIS) managed by Ministries of Education¹. EMIS typically include data types on education

¹ The document uses “Ministry of Education” as a general, umbrella term for the main government ministry with ownership of the national education agenda.

sub-sectors, including early childhood education, primary, secondary and higher education, and in some cases, technical and vocational training. An EMIS is meant to facilitate the collection, processing, analysis, monitoring, and dissemination of administrative data.



Fiji's EMIS (FEMIS) allows for individual-level monitoring of students throughout their school years and provides timely feedback to improve learning outcomes. FEMIS collects data on a student's biodata, families, daily attendance, learning outcomes, subsidy programs and disciplinary action. Through FEMIS, schools and teachers have access to annual reports on the country's standardized Literacy and Numeracy Assessment (LANA). Since the information is available the same year the assessment takes place, teachers and parents can implement corrective action. (UNESCO, 2019).



The EMIS system in **Gambia**² has helped the Ministry of Basic and Secondary Education (MoBSE) measure indicators for reporting, management and coordination, particularly through the development of the School Report Card (SRC) and Daily Teacher Attendance Monitoring. The SRC is a snapshot of a school's performance and a mode of benchmarking individual schools against certain metrics. It is used for annual school performance meetings where stakeholders from the Ministry, civil society and development partners review individual schools to improve the quality of education. The Teacher Attendance System allows reporting on teacher attendance through mobile devices. Reports are sent to EMIS regionally and nationally, using even SMS messages when internet connectivity isn't available (DHIS2 for education. 2022).

An EMIS can also integrate different data sources - not just from the education sector - into a unified information management system. For instance, if a common identifier exists, EMIS can connect with health information systems to analyze correlations between education and health variables. This multi-sectorial approach provides a comprehensive, multidimensional view of specific country challenges and, consequently, their solutions.



For further operational guidance on how to implement data collection with EMIS see: [Operational Guide to Using EMIS to Monitor SDG4 UNESCO \(2020\)](#).

2 Gambia implemented a DHIS2-based EMIS. [DHIS2](#) (District Health Information Software) is a free, open-source platform for data collection, dissemination, and analysis of collated and individual-level data. It is predominantly used in the healthcare sector but is now being seen in education as well.



For specific guidelines for data management and functionality in EMIS see: [Efficiency and Effectiveness in Choosing and Using and EMIS: Guidelines for Data Management Functionality in Education Management Information Systems](#). UNESCO (2020)

Who is responsible?

The data is collected by education institutions, school districts, and government agencies responsible for managing and overseeing the education system. The school survey questionnaire is the core component of most EMIS, serving as the foundation for administrative data collection. Most countries use the 'school-census approach' to collect information, where an annual census questionnaire is sent to schools to collect the education data the government needs to monitor the education system.



Brazil's *Censo Escolar Federal* (Federal School Census), is the largest in Latin America and the Caribbean, collecting data on over 47 million students (Montes, 2022).

Why is it relevant for education policy planning and SDG4 monitoring?

Administrative data plays a crucial role in addressing a wide range of policy questions and monitoring progress towards Sustainable Development Goal 4 (SDG4). These data sources offer a holistic view of the education system, allowing policymakers to identify trends, gaps, and areas for improvement in the education system. Moreover, making data accessible at all levels, such as to school administrators and teachers, through open data reporting can contribute to develop effective school-level – or even teacher and student-level – policies. Over a third of SDG4 indicators are measured using administrative data, underscoring the critical role that such data plays in advancing the Sustainable Development Goal for education.

Several policy questions can be addressed using administrative data:

- **What is the average student-teacher ratio by school level?** The average student-teacher ratio is crucial for optimizing educational quality, resource allocation, and equity in the education system. A lower ratio typically means more individualized attention and better support for students, leading to improved learning outcomes.
- **How are schools distributed across the country?** Is there a shortage of schools for certain grade levels? This information can help identify geographical disparities in access to education and facilitate the allocation of resources and infrastructure development where they are most needed.
- **Are children able to complete school?** At which age and levels do high proportions of over-age children exist? Is the education system able to retain students until the last grade

of the education cycle? Are students transitioning from one level to another? Are there high repeaters in different grades? Through these questions policymakers can discern at which age and levels a significant proportion of students lag behind, enabling the implementation of targeted support mechanisms to enhance retention and progression.

- **What is the impact of migration on the education system?** How many migrant students are there in the system? If available, administrative data can provide insights into the number of migrant students in the education system and evaluate the challenges posed by the influx of migrant students. This information is crucial for addressing migration-related challenges and ensuring access to quality education for all.
- **How to improve disability policies and what type needs more attention?** What is the percentage of disabled and types of disability? By collecting data on the number of students with disabilities, categorized by the type of disability, administrative data can assist in improving disability policies. This allows policymakers to identify areas that require more attention and resources.



For further information on EMIS standards, including operational guidance to monitor SDG 4, examples of EMIS software, EMIS questionnaires, an EMIS typology report, EMIS quality assessment tools as well as other relevant tools to establish or improve an EMIS see: [EMIS Knowledge Hub](#)

Financial and Expenditure Data

KEY TAKEAWAYS

- Financial and expenditure data encompass details about the allocation and utilization of financial resources within the education system.
- It often comes from administrative records gathered by the Ministry of Finance, Ministry of Education or National Statistical Offices.
- Financial and expenditure data helps policymakers understand how funds are being utilized and whether they are effectively contributing to their National Education Agendas and SDG4 objectives.

What is financial and expenditure data?

Data on **public spending** on education typically includes budgets, funding sources (national or international), and spending patterns related to various aspects of education, such as infrastructure development and maintenance, teacher salaries, supplies, curriculum development, student services, school feeding programs etc. **Private household spending** related to education includes data on tuition fees, textbooks, school supplies, and private tutoring (Figure 5).

Figure 5. Financial & expenditure data



FINANCIAL & EXPENDITURE

Resources

- ✓ Sources of funding (private/public)
- ✓ Total Expenditure
- ✓ Type of Expenditure (current/capital)

Who is responsible?

Data on education expenditure comes from administrative records gathered often by the Ministry of Finance, Ministry of Education or National Statistical Offices. Data on household expenditure is derived from expenditure surveys typically administered by NSOs.

Why is it relevant for education policy planning and SDG4 monitoring?

Finance and expenditure data serves as a crucial component for evaluating the efficiency, equity, and sustainability of educational initiatives and aids in making informed decisions regarding resource allocation and financial planning within the education sector. It helps policymakers understand how funds are being utilized and whether they are effectively contributing to their National Education Agendas and SDG4 objectives. This, in turn, facilitates efficient resource management and the allocation of budgets to areas that require the most attention.

Data from expenditure surveys could help quantify household out-of-pocket expenditure in education across socioeconomic groups and contribute to designing policies that ensure affordable and equitable access to education.

Such detailed financial information not only informs efficient resource management but also assists in making informed decisions regarding resource allocation and financial planning, ultimately contributing to the efficiency, equity, and sustainability of educational initiatives. This financial transparency aligns with the goals of education policy planning and SDG4 monitoring, ensuring that funds are effectively contributing to national education agendas and SDG4 objectives while promoting affordable and equitable access to education for all.

This information can help respond several policy questions regarding education expenditure and financing:

- Who funds education?
- How are different education levels financed?
- What is the average financing and cost per student?
- How much is allocated to teacher salary
- How much is allocated to capital expenditure (i.e., school infrastructure?)



For specifics on collecting, processing, and analyzing data on education expenditure see: [IIEP, UIS and Pôle de Dakar. \(2016\). Methodology of National Education Accounts.](#)

Household Surveys and Population Censuses

KEY TAKEAWAYS

- Household surveys and population censuses collect data on population and household demographics and socioeconomic indicators.
- Most surveys and censuses are conducted by National Statistic Offices, with little coordination with other line Ministries.
- They are the only source of data on those outside the formal education system, and provide context for education planning, including the socioeconomic factors that may influence educational outcomes.

What are household surveys and population censuses?

Household surveys are a country's most important source of socioeconomic data (Figure 6). They collect nationally representative data on population and household demographics, such as age, gender, ethnicity, and household composition, along with socioeconomic indicators like income, consumption, labor market outcomes, housing conditions, health, and access to basic services from a representative sample of the population. They play a crucial role in assessing economic well-being, measuring poverty and inequality, and monitoring social welfare policies.

Population censuses enumerate the entire population of a country and provide essential information on a population's spatial distribution, household demographics, living conditions, education, language skills, migration, and labor market outcomes.

Figure 6. Survey & Population Census education data



SURVEYS & POPULATION CENSUSES

- ✓ Literacy
- ✓ Educational attainment
- ✓ Expenditure and consumption patterns
- ✓ Household an individual level socioeconomic indicators
- ✓ Labor market indicators

Who conducts household surveys and population censuses?

A vast majority of household surveys and population censuses are conducted by National Statistic Offices, with little coordination with other line Ministries. Others are carried out with the support of international organizations, such as the World Bank's Living Standards Measurement Study (LSMS) or UNICEF's Multiple Indicator Cluster Surveys (MICs).

Why are they relevant for education policy planning and SDG4 monitoring?

Household survey data is pivotal to achieve SDG4 as it can help measure equity in education, thereby contributing to the monitoring of nearly half of SDGs. It provides context for education planning, highlighting the socioeconomic factors that may influence educational outcomes.

They are the only source of data on those outside of the formal education system, including out-of-school children, adults, ethnic minorities, children with disabilities, migrants, and other marginalized populations. They are also an important source of data on literacy rates, school dropouts, repetition, regional disparities, and labor market linkages. The latter can provide insights on the relationship between education and employment outcomes, identify skills gaps, and inform policies to align education and training with labor market demands.

Household survey data provides a comprehensive foundation for addressing crucial policy questions in the realm of education, including:

- **Do all kids have access to school?** Is access to education equitably distributed? Understanding access disparities helps identify and address barriers that may prevent certain children, particularly marginalized or disadvantaged groups, from attending school.
- **What factors contribute to the incidence of out-of-school children?** By collecting data on socio-economic factors, cultural influences, and regional disparities, policymakers can identify the root causes of children being excluded from education. Understanding these dynamics through household survey data is crucial to design targeted policies to address these barriers, promote inclusivity, and advance SDG4 objectives.



In **Nigeria**, approximately 10.5 million children are not in school. Even though primary education is free and compulsory, one in four children of primary school age are not in school. Education deprivation is particularly acute in northern Nigeria, with a net attendance rate of just 53 percent. In the north, more than half of Nigerian girls are out of school. Household surveys reveal that economic barriers and socio-cultural factors discourage school attendance, especially for girls (UNICEF, 2023).

- **How are labor market outcomes related to educational attainment?** By examining the relationship between education and employment outcomes, policymakers can identify

skill gaps and align educational and training programs with the demands of the labor market, fostering more effective education-to-employment transitions.

- **What is the adult literacy rate?** The adult literacy rate is a key metric for measuring a nation's progress and well-being. It provides insight into the effectiveness of past and current education policies and initiatives, allowing policymakers to make informed decisions for improving literacy rates.



For more on education data in household surveys see: [Module 4: Household Surveys for Monitoring SDG4. Regional Capacity Development Resource Book on Monitoring SDG4-Education 2030 in Asia-Pacific. UNESCO \(2019\)](#)

Learning Assessments

KEY TAKEAWAYS

- Learning assessments measure students' knowledge and skills.
- National assessments are often conducted by the Ministry of Education; several international organizations conduct regional and international assessments.
- Learning assessments help monitor the quality of education.

What are learning assessments?

Learning assessments measure students' knowledge and skills at a particular age or grade in specific subject areas such as reading and mathematics (Figure 7). They may also collect data on contextual factors that influence student performance, such as students' socioeconomic background, gender, ethnicity, parental education levels, school infrastructure and resources, teacher's professional development, students experiencing bullying and students' attitudes towards school and learning. Countries also administer **Public Examinations**, that are individual high stakes exams. All public exams are assessments but not all assessments are public exams.

Figure 7. Learning assessment measures student's learning and skills



LEARNING ASSESSMENTS

- ✓ National school-based assessments
- ✓ Test scores
- ✓ Student socioeconomics
- ✓ Characteristics
- ✓ Teacher/parent surveys
- ✓ International assessments

Who conducts learning assessments?

In most countries, the Ministry of Education or a related government agency is responsible for conducting national learning assessments. They design, implement, and oversee the assessments. For regional and international assessments, the responsible entity varies. The Programme for International Student Assessment (PISA) is a global study by the Organisation for Economic Cooperation and Development (OECD) used to assess fifteen-year-olds' performance in math, science, and reading. Likewise, the Trends in International Mathematics and Science Study (TIMSS) and the Progress in International Reading Literacy Study (PIRLS)

assess the academic performance of students in multiple countries. Similarly, UNESCO's Regional Comparative and Explanatory Study (ERCE) has been implemented across 16 countries in Latin America and the Caribbean.

Why are they relevant for education policy planning and SDG4 monitoring?

Learning assessments offer valuable insights into the quality and equity of education. Moreover, assessments that include contextual questionnaires for students, parents, and teachers enable in-depth analysis of equity in learning outcomes, offer valuable insights into the factors influencing academic performance and contribute to SDG4 monitoring.



Following a significant expansion of school coverage, **Mozambique** shifted its focus to improve education quality by implementing learning assessments. Mozambique invested in their first national learning assessment in 2013 and compared the results three years later. The results revealed a stark lag in quality of primary school education; notably, the 2013 assessment revealed that only 6 of every 100 primary school children in the country met the target reading and writing proficiency levels. Since then, the country has turned its attention to improving and adapting the primary school education curriculum to international standards (World Bank, 2021).

National learning assessments aim to measure the extent to which students in a given country meet the key learning objectives stipulated in the national curriculum. Thus, most national assessments are not comparable across countries. Instead, **regional and international student assessments** are used for cross-country comparisons and monitoring of SDG indicator 4.1.1. For more on resources to measure learning outcomes see section "Potential Bottlenecks and Solutions", sub-section on [UIS Resources](#).



According to 2019 results of the Trends in International Mathematics and Science Study (TIMSS), while **Morocco** has made some progress in terms of student learning outcomes it remains below the international average. Out of 64 participating countries, Morocco ranks among the bottom five countries in mathematics and science. Similarly, in both Grades 4 and 8, less than 2 percent of students reached the advanced international benchmark level in both subjects (Mullis, et al., 2020).

Some of the policy questions that can be addressed using data from learning assessments include:

- **Are children learning?** By monitoring and understanding learning outcomes, policymakers can identify areas of improvement, allocate resources more efficiently, and tailor interventions to meet students' needs.

- **Is there any difference in academic performance between boys and girls?** This data can potentially address gender-based disparities in education and implement targeted interventions to ensure gender equity in learning outcomes.
- **Is there any difference in academic performance across socioeconomic groups?** With this information, policymakers could identify disparities in access to quality education and design targeted interventions to bridge the achievement gap and provide opportunities for disadvantaged students.



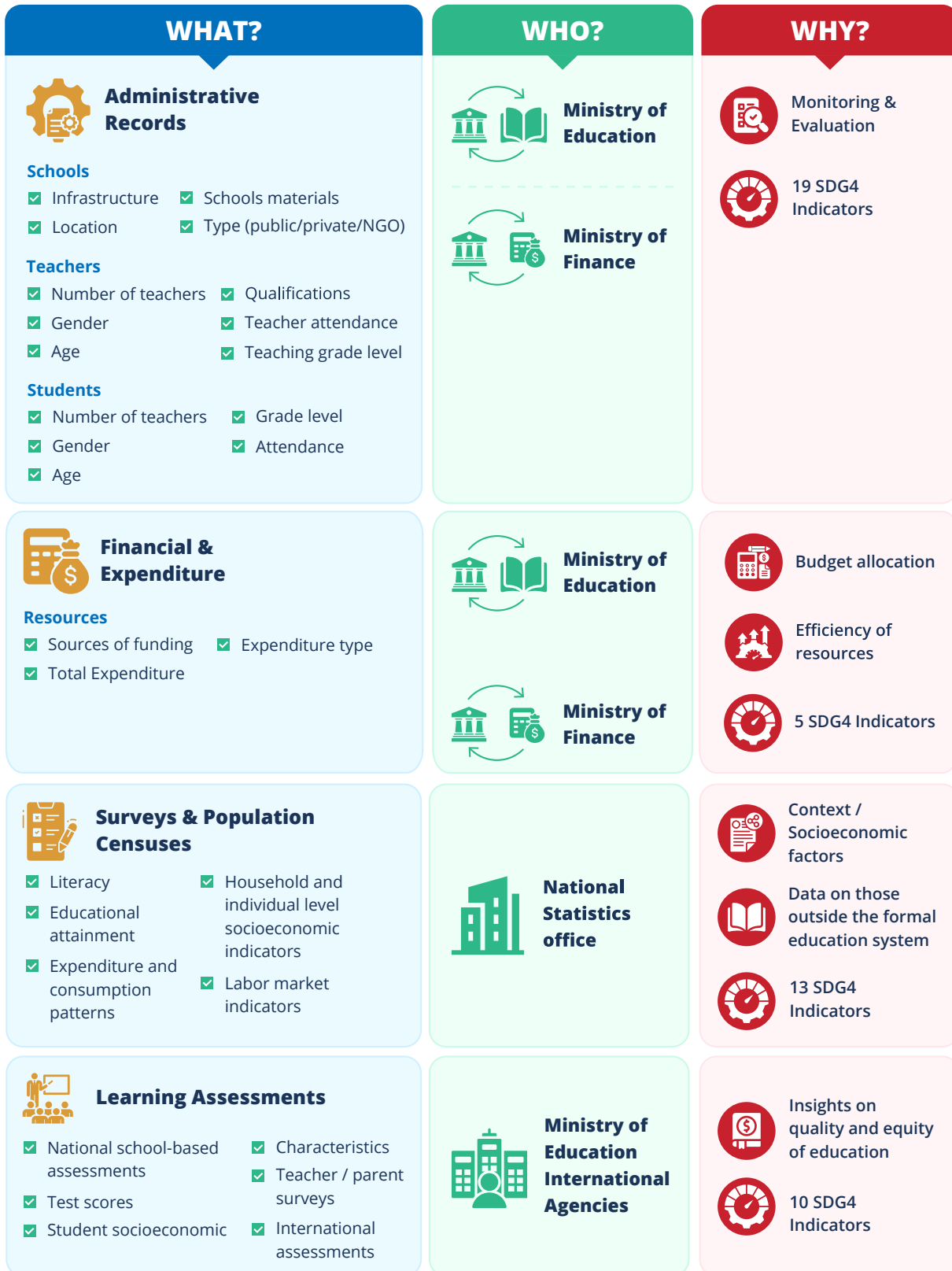
The 2018 PISA scores in **Thailand** highlight differences in performance by socioeconomic status and gender. On average, 15-year-old girls outperformed boys in all subjects. Across socioeconomic groups, literacy scores were 69 points higher among well-off students, with socioeconomic status explaining 12 percent of the differences in performance. Furthermore, in reading, students in rural areas scored approximately 39 points lower than those in urban communities (OECD, 2019).

- **Are teachers qualified? Does teacher training affect learning outcomes?** Policymakers can use this information to establish and enforce teacher certification standards, provide professional development opportunities, and allocate resources to ensure a well-qualified teaching workforce.



For a comprehensive guide on measuring learning outcomes see: [UNESCO Institute for Statistics | Reporting learning outcomes in basic education: Country's options for indicator 4.1.1 \(2023\)](#)

Figure 8. A comprehensive view of Education Data Sources



Combining Data Sources: Value-Added Analysis

KEY TAKEAWAYS

- The ability to provide value-added analysis by combining data sources and/or linking different databases using a common identifier is essential to generate high-quality data

Data from administrative records, surveys and censuses as well as learning assessments can be combined to further inform education policy design (Figure 9). The ability to provide value-added analysis by combining data sources and/or linking different databases using a common identifier is essential to generate high-quality data. It is only through these iterations that end-users, including policymakers, can fully appreciate the substantial value that data can provide to address major challenges in the education sector.

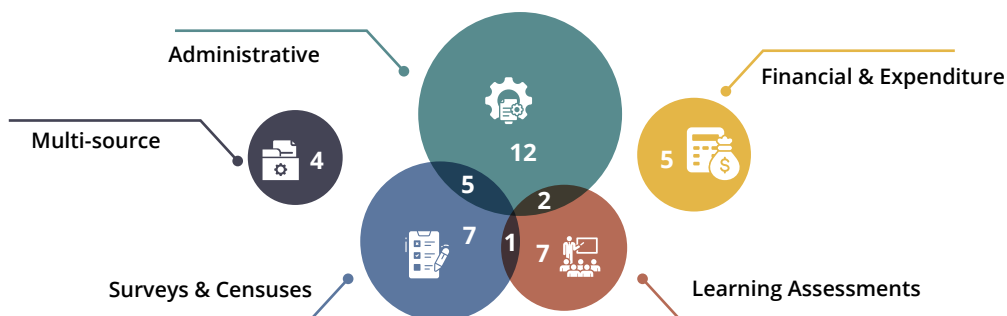
- **Are learning outcomes related to overcrowded classrooms?** Without complementary administrative data and learning assessments it wouldn't be possible to respond this inquiry. This underscores the importance of maintaining comprehensive records of teacher distribution across schools and districts. Access to administrative data encompassing student-teacher ratios per classroom and grade level, which can be correlated with learning assessment results, facilitates the examination of potential connections between class size and educational achievements. Such insights are invaluable for the precise targeting of policies and interventions to enhance the quality of education.
- **What policies can be used to keep children in school?** When considering policies aimed at improving school attendance and retention, the combination of administrative data (which provides insight into school enrollment and school location), household survey data (which captures information on out-of-school children and the factors influencing their non-attendance), and data from other Ministries (such as health or social protection initiatives) becomes crucial. Moreover, if there were a common identifier that could link education administrative records with data from social protection programs (such as Conditional Cash Transfers), it would be easier to evaluate the effectiveness of policies and social programs in keeping children in school.

In **Brazil**, since 2007, it is possible to access federal government databases to gather information on *Bolsa Família* (Family Allowance) and the *Benefício de Prestação Continuada* (Continued Benefit Provision). At the subnational level, the system is interoperable across schools, enabling teachers to access information from all the schools they work in. Verification is also possible with the *Cadastro Geral de Pessoa Física* (CPF, General Registry of Individuals) to confirm personal data, as well as cross-referencing between the *Educacenso* and *Censo Escolar* (School Census) (Montes, 2022).

- **How can we ensure the effective and efficient allocation of resources to schools and students with the greatest needs?** This entails merging administrative records, financial and expenditure data, household survey data, and other relevant sources to precisely identify areas or individuals requiring targeted support. Poverty maps typically constructed from household surveys and censuses can be overlaid with administrative data on school location to identify regions with high poverty rates and potentially higher repetition or drop-out rates. This information can help optimize resource allocation, earmark funding and support to schools in areas with limited resources and poor educational outcomes.
- Moreover, spatial data can help identify hard-to-reach students and provide insights into transportation networks, connectivity (electricity and broadband access), and healthcare facilities in the vicinity of a school. This information is valuable to plan infrastructure improvements that can enhance access to education and support student well-being.

In 2015, a project in Bonsaaso, **Ghana** used mobile phones to collect real-time data and provide monthly feedback to schools and district education offices. The data showed that schools without full-time teachers were also those where students lacked basic reading skills. Moreover, as this information was combined with geographic data at the district-level, the analysis revealed these schools were located in areas that lacked basic infrastructure, suggesting teachers were reluctant to work there (Broadband Commission for Sustainable Development. 2020).

Figure 9. Combining Education Data Sources to better policy solutions



Quality Data: Relevance, Comparability, Access

KEY TAKEAWAYS

- Relevant, comparable, and accessible data are necessary inputs for education data to be used effectively for evidence-based policymaking.
- Internationally comparable data naturally feeds into the monitoring of SDG4 global education progress and both contributes to and harnesses peer comparisons via benchmarks.
- Data reporting should guarantee open, quality, and timely data access for various stakeholders, leveraging feedback from diverse audiences to continuously improve data quality.

Policymakers must strive to generate quality data that is relevant, comparable, and accessible (Figure 10).

Relevance

Relevant data is crucial to generate data-driven policies. It's not just about having information; it's about having the right information. Designing a clear and relevant questionnaire (and/or test in the case of learning assessments) is critical as the relevance of the information collected is directly linked to asking the right types of questions and getting reliable answers. For instance, in cases where household survey or census data collection occurs during school closure periods, specific question that allows households to indicate children are on vacation should be included. Failing to address this can lead to invalid responses, potentially resulting in lower enrollment rates erroneously attributed to children being out of school rather than being on vacation.

Likewise, it is important to have disaggregated data on the groups of interest to education practitioners (i.e., schools, teachers, students etc.). Data available only at very aggregate levels, such as school or district data, can limit the ability to tailor policies for at-risk students. Without student-level data, it becomes challenging to identify and assist individual students who may require additional support, like those with special educational needs or those at risk of falling behind. Similarly, teacher-level data is crucial for assessing the performance of educators and tailoring professional development programs to their specific needs.

Similarly, ensuring data is up-to-date is vital to accurately assess and address the unique needs and challenges within the educational landscape. Outdated data can lead to policies and strategies that do not align with the current learning context, potentially missing out on crucial

insights that can inform decision-making. For example, if a policy is designed based on data from several years ago, it may not take into account recent changes in student demographics, learning technologies, or teaching methods, rendering it ineffective and potentially irrelevant.

Comparability

Comparability over time within and/or across countries requires a consistent data production process. Differences in questionnaire design, sampling, data collection, and interview methods may lead to very different results. For instance, even as countries were able to conduct phone interviews during the 2020 pandemic, this implied changes in sampling, higher non-response rates and modified questionnaires. These changes affected data comparability with previous years. For learning assessments, the timing of the assessment (i.e., at the beginning of the year versus the end) and content being examined may vary. Regardless of when countries choose to deliver the assessments, the exams should be administered at the same time every year to ensure comparability over time.



In **India**, estimates from survey and census data of the primary out-of-school rate between 2011 and 2014, range from 3 percent to nearly 20 percent. These differences are attributed to the definition of attendance used, problems with students' age data and the types of schools covered by each data collection instrument (De and Shekhar Mehra, 2016).

Though internationally comparable and harmonized data can be difficult to achieve in the education sphere in the case of lacking global frameworks, significant benefits exist for all countries who provide and utilize, internationally comparable data. Cross-country comparability ensures that policymakers have benchmarks for their education goals and metrics. Beyond the technical value of benchmarks, the material benefits for countries come from transforming data into national policy and using these metrics as the basis for national, regional, and global discourse on the state of SDG 4. The strength of the SDG 4 global monitoring framework depends on the quality of the data produced at the national level (UNESCO Institute for Statistics, 2017b). Aligning baseline data with international benchmarks creates a common narrative for policy feasibility and ambition. If national and international data differ, policy prescriptions might differ as well. Moreover, embedding national benchmarks in international discussions allows for peer learning and knowledge transfers that can be used to improve countries' national education agendas.

Access

Data access can be a crucial catalyst in activating a virtuous cycle of data quality improvement. Data users might come from a diverse array of backgrounds - administrative, investigative, academic, social - and consequently seek to use the data for a variety of purposes. These diverse perspectives should be valued for their unique insight and feedback to improve data quality.

- **When appropriate, education government officials should strive to enhance access to open data for all data sources.** Open data refers to publicly available data, usually free of charge. The value of data can be better realized when a broad range of users can easily find it (Oseni, et al., 2021).



Mexico's online platform *Mejora tu Escuela* provides citizens with open access to public and private school performance indicators and budget data, enabling parents to make data-driven decisions on their children's school choice. This effort has increased transparency, brought attention to quality and discrepancy issues within budgetary data, and encouraged citizens to participate more in the education policymaking process (Young and Verhulst, 2016).

Publicly-available data by itself is not valuable unless it's easy to use. When possible, ministries should strive for open, free, public access of all data sources and types, including the microdata³ and metadata, or "data about data," that comprises these datasets, in research-friendly formats like spreadsheet-compatible formats (Excel, XML, CSV, etc.) and programming language-compatible formats (JSON), rather than text-only formats like Word and PDF.⁴ Reporting data in research-friendly formats is particularly important for a country's long-term education aspirations: a lack of research can truncate demand for education data, which further limits investment in data collection, leading to a reduction in data-driven policies. This vicious cycle can continue, resulting in an overall reduction in the reach and quality of education. This applies to EMIS as well, as a system that is not user-friendly can have limited use potential.

The timing of data dissemination has important implications for its use and relevance.

Reporting data years after its collection might preclude governments from taking effective action; for example, education sector challenges that have changed throughout the years might not be reflected in outdated data reports. A good rule of thumb to follow, according to international standards, is to disseminate data within one year of the end of data collection (Oseni, et al., 2021).




Both countries and international agencies should take accountability for improving data collection practices, especially when data is collected and analyzed using public funds.

Ensuring public access and ease of use is a first step towards realizing this commitment, but governments must go further and expand this commitment to the international arena.

3 Microdata refers to unit-level information, i.e., individual respondent's data (properly anonymized).

4 See Open Data Handbook. "File Formats". <https://opendatahandbook.org/guide/en/appendices/file-formats/>.

Figure 10. Data Quality Checklist

IS THE DATA...		
RELEVANT	COMPARABLE	ACCESSIBLE
 Does the data source include the required information?	... over time?	... to all users/open access?
 Is the data available for the groups of interest (i.e., school, student, teacher, private and/or public schools etc.)?	... across countries?	... in a user-friendly format?
 When was the data published (latest year available)?		... in a timely manner?
Is it interoperable with other data sources via a common identifier?		

Potential Bottlenecks and Solutions

KEY TAKEAWAYS

- A shortage of skilled human capital, limited resources, and poor communication between different stakeholders represent significant bottlenecks for all data sources.
- Some of these challenges can be addressed with technological solutions.
- The UNESCO Institute for Statistics (UIS) collaborates with countries to facilitate data reporting via methodological guidance, standard-setting, and capacity-building, paving the way for both national data-driven policies and global SDG4 progress.

Given the significance of the Education Data Ecosystem for practitioners, special attention ought to be channeled to the potential challenges that prevent the production of quality data and its widespread use:

Bottlenecks

Shortage of skilled human capital

Statistical technical capacity in developing countries, especially in ministries, is often weak. Without the necessary technical capacities to analyze and interpret education data and ensure data interoperability with other datasets to generate comprehensive analyses, the policy applications of these analyses become significantly limited. Inadequate skill development and training for education staff can hamper data analysis and the use of an EMIS, household surveys, and learning assessments for policy purposes. Ideally, countries should channel resources to hiring trained statisticians and data analysts for these purposes; however, these resources might not always be available.

High turnover rates among scarce staff members create expertise gaps and increase the pressure to recruit and train new personnel, especially in the context of EMIS platforms. Effective solutions involve reducing turnover rates through organizational efforts and maintaining up-to-date documentation and protocols. While short-term resource constraints may lead to outsourcing the EMIS platform, it can exacerbate in-house talent gaps and strain limited budgets in the long run. Exploring alternatives like UNESCO's OpenEMIS can provide technical support while developing local staff expertise.



In 2015, with the support of UIS and UNICEF, the **Maldives** strengthened and customized their EMIS according to the country's needs. The country opted for OpenEMIS as the base software for the Maldives Education Management Information System (MEMIS). As switching from a manual to a digital system required a different skill-set, the Maldives Ministry of Education prioritized capacity building to train all personnel (including the central office and individual schools) to effectively use MEMIS (UNESCO, 2018).

Sustainable EMIS operation depends on comprehensive and regular training for users and administrators, even when using external software providers. Neglecting capacity-building may result in a heavy reliance on external consultants, limiting system utilization and potentially disrupting the flow of information within the education system (Carrizo et al., 2003; Abdul-Hamid, 2014; Lishan, 2011). Prioritizing skill development and training for local staff is essential for maintaining a self-reliant and efficient education data ecosystem.

Limited Resources

Many countries lack the financial resources needed to conduct granular and frequent data collection. Donor contributions play a central role in financing the majority of budgets in several sub-Saharan African countries, where essential data collection efforts heavily rely on external financial support (Glassman 2014). Countries should prioritize availability of data sources that are fundamental for national policies. For example, if access remains a major problem, resources should be earmarked towards data collection efforts to understand where and why coverage is low, as opposed to measuring quality of education.

Lack of resources in the form of infrastructure and technological constraints is another common challenge. Internet connectivity and electricity issues, or a lack of both altogether, might require governments to opt for paper-based methods in rural and remote areas. In this case, countries can transition to an offline/online data collection method in order to minimize the errors, costliness, and logistical challenges of fully offline approaches. Ideally, countries could purchase offline tablets to replace paper surveys in these areas. Countries might foster relationships with international organizations in order to obtain resources for this end.

Lack of coordination

Effective cross-sectoral communication is essential to produce relevant quality data. Unfortunately, many developing countries lack a sector-wide strategy to generate education statistics. The active engagement of Ministries of Education in the data production process is indispensable for crafting data that resonates with their national education agendas. This involvement should extend to all data sources, transcending the boundaries of their own ministries. For instance, in order to maximize use of household survey data, Ministries of Education should be involved at the very minimum in designing the education questionnaire to guarantee the generated data from the NSO is aligned with their specific educational objectives and compatible with their EMIS.

Moreover, oftentimes, top-down pressure to deliver on certain deadlines can hasten the data production process, resulting in faster delivery times at the expense of quality. Policymakers must understand that producing quality data that is relevant, comparable and accessible takes significant planning. Thus, a clear articulation of the mutual benefits of quality data and its inextricable link to the data production process is vital.

Potential Solutions




Technology

Data challenges can be addressed with technological solutions that do not necessarily imply large investments in technology (Figure 11). Countries can utilize their current infrastructure capacity, including basic phones (i.e., non-smartphone) and readily-available software (i.e., Excel) to capture and disseminate data. Furthermore, with the widespread availability of mobile connectivity and GPS-enabled devices, it is possible to record the geographic location of schools, students or households interviewed. Over 70 percent of countries currently collect geographic coordinates of their schools (UNESCO Institute for Statistics, 2020). Even though it entails higher initial expenses due to the required investments in hardware and capacity, increasingly countries are attempting to shift to a technology-based system. Overall, technology can help lower the cost of data collection and analysis and minimize error rates.



In 2013, Honduras switched to a web-based EMIS that consolidated student, teacher and school-level information. The system helped eliminate almost 3,000 ghost workers from the education payroll, saving the country nearly USD20 million annually (equivalent to a 15 percent reduction in annual teaching payroll) (Inter-American Development Bank, 2016 and Hernandez, et al., 2016).

Figure 11. Pros and Cons of Technology vs. Paper Data Collection

	TECHNOLOGY	PAPER
 TIME	Improves timeliness of data collection	Logistically challenging & delays timelines of data
 QUALITY	Embedded data quality checks	Error & prone; relies on manual data entry
 COST	Cost-effective	Higher costs (printing, data entry, field staff training)

A cohabitation of technologies is another potential solution, wherein manual (offline) and automated methods (online) are both used. Due to the absence of internet connectivity (or even electricity access) and limited facilities in remote school locations, offline-paper methods continue to be the preferred mode of data collection and storage for EMIS in many countries. While most countries in South and West Asia and Latin America and the Caribbean use online interfaces (78 and 71 percent respectively), paper prevails as the leading method of data collection in sub-Saharan Africa (81 percent of countries) (UNESCO Institute for Statistics, 2020).



Mauritius uses paper-based surveys to track early childhood development and relies on an online interface using Microsoft Excel spreadsheets for the secondary level.⁵ Similarly, while most schools in **Tonga** are connected to a national database, those in the remotest areas still rely on paper-methods (UNESCO Institute for Statistics, 2017a).

In order to foster a culture of data-driven decision-making within government the adoption of an data strategy that provides the vision and strategic goals of the education data including the data legal framework and governance, build human capacity to leverage data, ensure relevance by harnessing existing data and anticipate future needs and advance the strategic use of data improving access, transparency, and protection of privacy.

Adoption of an education data strategy

To foster a culture of data-driven decision-making within governments, it is imperative to implementing a robust data strategy encompassing a well-defined vision and strategic goals for the education data (Figure 12). This strategy must prioritize strengthening diverse data sources to render them relevant for policymaking. It should include the establishment of a legal framework and governance for data, the enhancement of human capacity to leverage data, and the assurance of relevance by making use of existing data while anticipating future data requirements. Moreover, the strategy should propel the strategic use of data to improve access, transparency, and privacy protection.

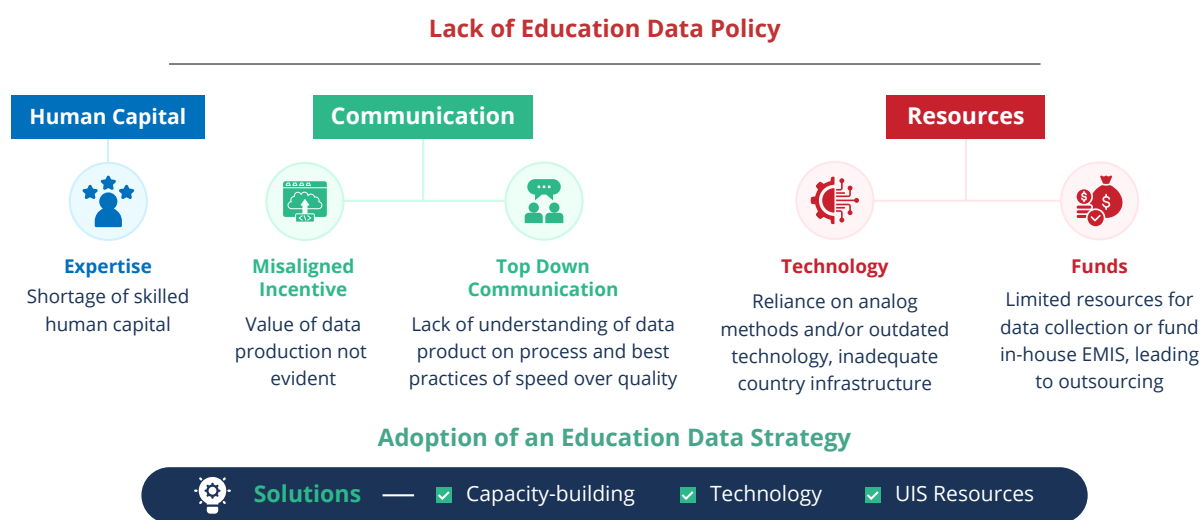
A comprehensive data set, compiled and integrated from different data sources, is essential to produce quality data with the highest coverage possible. A strategy aligned with common goals would improve strategic data management challenges by adhering to common principles, such as data sharing and data standardization, gearing progress towards an evidence-driven decision-making.

The envisioned data strategy aims to improve coordination, collaboration and planning across education data producers, including the MoE, NSO and other line Ministries. This involves implementing data-related initiatives and establishing mandates, along with providing mechanisms for data collection, compilation, and harnessing technologies to reduce data duplication and gaps.

5 These are subsequently sent via post and edited and coded by statistical officers.

Data use should be at the center of any data strategy. This entails establishing clear processes, including data analysis and reporting mechanisms, with appropriate formats and structure for data reporting. These measures enable various stakeholders to leverage the data effectively to achieve the country's education agenda.

Figure 12. Potential Bottlenecks and Solutions



UIS Resources

Countries have access to an array of resources from organizations like the UNESCO Institute for Statistics (UIS) to help education practitioners and policymakers build capabilities and obtain methodological guidance to arrive at the indicators required to achieve SDG 4.

A crucial feature of UIS' role in assisting countries report internationally comparable data is **standard-setting and methodological guidance for Member States**. Policymakers can leverage frameworks, initiatives, and documents provided by UIS and other organizations to obtain this guidance. Adhering to global frameworks enables a smoother reporting of education assessment data to meet the SDGs. Some highlighted resources and initiatives are listed below:

- **The Global Proficiency Framework (GPF)** is one such example. The GPF standardizes the minimum proficiency levels (MPLs) for students in grades one to nine in reading and math. Adhering to these frameworks enables a smoother reporting of education assessment data to meet the SDGs.
- **The International Standard Classification of Education (ISCED)** is another example – an internationally agreed comprehensive framework for classifying education programmes and related qualifications. It allows the comparison of education systems across countries and the production of cross-nationally comparable data. UIS has produced ISCED diagrams and visualizations to help countries report on SDG 4 effectively by presenting the education systems of +130 countries.

- Conceptual, methodological and reporting frameworks for various SDG 4 indicators⁶ are listed in the [UIS Monitoring Framework site](#). These are succinctly summarized in the [UIS Indicator Dashboard](#).
- **The Learning Data Toolkit: Measure What Matters** microsite gives users free and open access to studies and resources on new methodologies for SDG indicator 4.1.1. This initiative aims to facilitate cross-nationally comparable data reporting on learning outcomes and provide countries with internationally-aligned, but context-specific, options to report on this indicator.
- The **Global Alliance to Monitor Learning (GAML)** supports national strategies for learning assessments and creating globally comparable indicators and methodologies. The GAML works with the Technical Cooperation Group on the Indicators for SDG4 - Education 2030 (TCG) to support the use of learning assessments to report for SDG4. Part of the work includes the [Global Coalition for Foundational Learning](#), the development of the [Policy Linking methodology](#)⁷ and the [Assessment for Minimum Proficiency Levels \(AMPL\)](#). Both tools are meant to facilitate monitoring of SDG 4.1.1 and produce reliable global benchmarks.
- **Rosetta Stone** is a methodological program for countries who seek to improve the global comparability of international large-scale assessments (ILSAs), offering strategies to feed ILSA results into SDG indicator 4.1.1.
- The **International Standard Classification of Teacher Training Programmes** (ISCED-T 2021) is a framework for internationally-comparable statistics on teacher training programs and qualifications. UIS has produced ISCED diagrams and visualizations to help countries report on SDG 4 effectively by presenting the education systems of +130 countries.
- **[Reporting learning outcomes in basic education: Country's options for indicator 4.1.1 \(2023\)](#)**

Finally, to assist in the implementation of the recommended methodologies, UIS offers a series of in-person and virtual workshops and trainings around the globe. Previous work has allowed for capacity-building in the usage of dynamic templates to report and analyze SDG 4 indicators, the setting of nationally and internationally-relevant education benchmarks, and the building of expertise in policy linking to align national assessment data with the Global Proficiency Framework (GPF).



For more information on all data sources used to measure SDG4 see: Background Information on Education Statistics in the UIS Database UIS (2023)

⁶ See <https://sdgs.un.org/goals/goal4>

⁷ At the moment of writing this report the tool was still in a piloting phase and not being used to report SDG 4.1.1.

Fit-for-Purpose Data Ecosystems

The sustainability of the education data ecosystem relies on a country's commitment and ability to identify, produce, and analyze data themselves. Resources must be devoted to strengthen in-house capacity to analyze and process the information produced. This includes training data engineers to understand education policies and priorities in order to incorporate these elements in the data production cycle. Without the necessary technical capacities to analyze and interpret education data, the policy applications of these analyses become significantly limited. Extensive utilization of data can trigger a positive feedback loop, fostering increased investment and demand for data. As countries start to assess and quantify the advantages of demand-driven policymaking for their education agendas, this fuels a growing interest in data usage.

Countries should strive to establish sustainable 'fit-for-purpose' data ecosystems that are rooted with national education policies and priorities (Figure 13). As policymakers aim to improve their education systems, it is important to recognize that achieving an ideal data ecosystem may be challenging due to limited resources and human capital. Therefore, what an EMIS measures and the information chosen to be collected by household surveys or learning assessments should be linked to *national* priorities. Data should enable policymakers to assess progress against those specific priorities. If access to schooling remains a prominent issue, countries may prioritize access-related indicators before investing in quality-related indicators. By implementing a sustainable model of continuous improvement that relies on iterative evaluations, policymakers can make steady progress towards an efficient and effective education data system that ultimately achieves better learning outcomes for all, contributing to global progress for the 2030 Education Agenda.

Figure 13. From a vicious cycle to a virtuous Education Data Cycle



References

- Abdul-Hamid, Husein. 2014.** "What Matters Most for Education Management Information Systems: A Framework Paper". Working Paper Series Number 7. Systems Approach for Better Education Results (SABER). http://wbfiles.worldbank.org/documents/hdn/ed/saber/supporting_doc/Background/EMIS/Framework_SABER-EMIS.pdf
- Broadband Commission for Sustainable Development. 2020.** "The Digital Transformation of Education: Connecting Schools, Empowering Learners". September 2020. https://unesdoc.unesco.org/in/documentViewer.xhtml?v=2.1.196&id=p::usmarcdef_0000374309&file=/in/rest/annotationSVC/DownloadWatermarkedAttachment/attach_import_7f83bae6-2875-4daa-b92e-505787f3b0c5%3F_%3D374309eng.pdf&locale=en&multi=true&ark=/ark:/48223/pf0000374309/PDF/374309eng.pdf#output-1.indd%3AAnchor%2057%3A275
- Carrizo, Luis, Claude Sauvageot, and Nicole Bella. 2003.** "Information Tools for the Preparation and Monitoring of Education Plans". Education Policies and Strategies 5. Paris. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000132306>
- De, Anuradha, and Chander Shekhar Mehra. 2016.** "Estimating the Number of out-of-School Children: Methodological Problems and Alternative Approaches - India Case Study". New Delhi. UNESCO Institute for Statistics and UNICEF. <https://unesdoc.unesco.org/ark:/48223/pf0000245213>
- DHIS2. "About DHIS2".** DHIS2. Retrieved 5 July 2023 from <https://dhis2.org/about/>
- DHIS2 for education. 2022.** "Innovative Use of DHIS2 to improve education quality by fostering equity and inclusivity in the Gambia". Retrieved 5 July 2023 from <https://education.dhis2.org/2022/10/15/innovative-use-of-dhis2-to-improve-education-quality-by-fostering-equity-and-inclusivity-in-the-gambia/>
- Glassman, Amanda and Alex Ezeh. 2014.** "Delivering on a Data Revolution in Sub-Saharan Africa". Center for Global Development. Briefs 7/7/14. <http://www.cgdev.org/publication/delivering-data-revolution-sub-saharan-africa>
- Gustaffson, Martin. 2019.** "Costs and Benefits of Different Approaches to Measuring the Learning Proficiency of Students (SDG Indicator 4.1.1)". Information Paper 53. Montreal. UNESCO Institute for Statistics. January 2019. <http://uis.unesco.org/sites/default/files/documents/ip53-costs-benefits-approaches-measuring-proficiency-2019-en.pdf>
- Hernandez Ore, Marco; Liliana D. Sousa, and J. Humberto Lopez. 2016.** "Honduras: Unlocking Economic Potential for Greater Opportunities". Systematic Country Diagnostic. Washington D.C. The World Bank. <https://documents1.worldbank.org/curated/en/519801468196163960/pdf/103239-v2-PUB-P151906-Box394858B-PUBLIC-DOI-10-1596K8570-EPI-K8570.pdf>
- Inter-American Development Bank. 2016.** "HO-T1224: Maximizing the Impact of Information Technology and Communications in the Education Sector". <https://www.iadb.org/es/project/HO-T1224>
- Adam, Lishan. 2011.** "How Can Holistic Education Management Information Systems Improve Education?" Educational Technology Debate website. <https://edutechdebate.org/education-management-information-systems/how-can-holistic-education-management-information-systems-improve-education/>

- Montes, Nancy.** 2022. "Usos de los sistemas de información en el planeamiento y gestión de políticas educativas en América Latina". Informe regional. Buenos Aires. UNESCO Instituto Internacional de Planeamiento de la Educación. <https://unesdoc.unesco.org/ark:/48223/pf0000385439/PDF/385439spa.pdf.multi>
- Mullis, Ina V.S.,** Michael O. Martin, Pierre Foy, Dana L. Kelly, Bethany Fishbein. 2020. "TIMSS 2019 International Results in Mathematics and Science". Chesnut Hill. TIMSS and PIRLS International Study Center and Lynch School of Education, Boston College. <https://timss2019.org/reports/wp-content/themes/timssandpirls/download-center/TIMSS-2019-International-Results-in-Mathematics-and-Science.pdf>
- OECD.** 2019. "Thailand Country Note: PISA 2018 Results". OECD. https://www.oecd.org/pisa/publications/PISA2018_CN_THA.pdf
- OECD.** "PISA". OECD. Retrieved 5 July 2023 from <https://www.oecd.org/pisa/>
- Open Data Handbook.** "File Formats". Open Knowledge. Retrieved 5 July 2023 from <https://opendatahandbook.org/guide/en/appendices/file-formats/>
- Oseni, Gbemisola, Amparo Palacios-Lopez, Harriet Kasidi Mugeru, and Josefina Durazo.** 2021. "Capturing What Matters: Essential Guidelines for Designing Household Surveys". LSMS Guidebook. World Bank Data Production and Methods Unit. March 2021. <https://documents1.worldbank.org/curated/en/963531615786610706/pdf/Capturing-What-Matters-Essential-Guidelines-for-Designing-Household-Surveys.pdf>
- UNESCO Institute for Statistics.** 2023. "Background Information on Education Statistics in the UIS Database". UNESCO Institute for Statistics. March 2023.
- UNESCO Institute for Statistics.** 2020. "Operational Guide to Using EMIS to Monitor SDG 4". Montreal. UNESCO. <https://emis.uis.unesco.org/wp-content/uploads/sites/5/2020/09/EMIS-Operational-Guide-EN-WEB.pdf>
- UNESCO Institute for Statistics.** 2017a. "The Data Revolution in Education". Information Paper No. 39. Montreal. UNESCO Institute for Statistics. March 2017. <http://uis.unesco.org/sites/default/files/documents/the-data-revolution-in-education-2017-en.pdf>
- . 2017b. "The Quality Factor: Strengthening National Data to Monitor Sustainable Development Goal 4". SDG 4 Data Digest 2017. Montreal. UNESCO Institute for Statistics. <https://uis.unesco.org/sites/default/files/documents/quality-factor-strengthening-national-data-2017-en.pdf>
- UNESCO.** 2019. "Regional capacity development resource book on monitoring SDG4-Education 2030 in Asia-Pacific". UNESCO Office Bangkok and Regional Bureau for Education in Asia and the Pacific, UNICEF Regional Office for East Asia and the Pacific. Paris. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000372228>
- UNESCO.** "Regional Comparative and Explanatory Study (ERCE 2019)". UNESCO. Retrieved 5 July 2023 from <https://www.unesco.org/es/articles/estudio-regional-comparativo-y-explicativo-erce-2019>.
- UNESCO.** 2018. "Re-orienting Education Management Information Systems (EMIS) towards inclusive and equitable quality education and lifelong learning". Working Papers on Education Policy. Paris. UNESCO. 2018. https://www.openemis.org/wp-content/uploads/2018/05/UNESCO_Re-orienting_Education_Management_Information_Systems_EMIS_towards_inclusive_and_equitable_quality_education_and_lifelong_learning_2018_en.pdf

UNICEF. 2023. "UNICEF Nigeria Highlights 2018-2022 Key Results for Children." UNICEF. <https://www.unicef.org/nigeria/media/7181/file/COAR.pdf>

World Bank. "About LSMS". The World Bank. Retrieved 5 July 2023 from <https://www.worldbank.org/en/programs/lsms/overview>

World Bank. 2021. "Mozambique 2021 Systematic Country Diagnostic: Coming Together for a Better Future." Systematic Country Diagnostic. Washington D.C. The World Bank. <https://documents1.worldbank.org/curated/en/689471634758834825/pdf/Mozambique-2021-Systematic-Country-Diagnostic-Coming-Together-for-a-Better-Future.pdf>

Young, Andrew and Stefaan Verhulst. 2016. "Mexico's Mejora tu Escuela: Empowering Citizens to Make Data-Driven Decisions about Education". GovLab, NYU. January 2016. <https://odimply.org/files/case-study-mexico.pdf>

