LEARNING BRIEF

#03

How Can EMIS be Designed and Implemented in Ways That Make Them Useful?

EdTech Hub

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EdTech Hub is a global research partnership. Our goal is to empower people by giving them the evidence they need to make decisions about technology in education. Our evidence library is a repository of our latest research, findings, and wider literature on EdTech. As a global partnership, we seek to make our evidence available and accessible to those who are looking for EdTech solutions worldwide.

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About the Learning Brief Series

The EdTech Hub Learning Brief Series provides practical resources for people working to improve how technology is used in education. The briefs are specifically designed to help busy decision-makers working in low- and middle-income countries.

The Learning Briefs each address a specific technical question. Each one explains why the question matters, provides insights to help with effective decision-making, and identifies issues that require further work. They are based on practical evidence generated through the work of EdTech Hub and from across the sector.

We want to make EdTech evidence accessible so that it can be used to improve both policymaking and implementation.

Please contact EdTech Hub to share your ideas for new Learning Brief topics which would help you in your work.

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Why this question matters

Education management information systems (EMIS) are crucial for the administration and operation of schools and their education systems: they link processes and functions from fragmented analogue formats to an integrated digital system, which generates meaningful linked data. With increased awareness and appetite for using this education data in policymaking and planning, the demand for EMIS has increased. For EMIS to be useful for decision-making, schools must use them to generate the foundational data upon which strategic insights can be based. At the same time, in order to be used by schools, they must be implemented in ways which are recognised as useful by schools.

Despite decades of focus on developing EMIS, three main problems persist.

1. EMIS are rarely designed for the needs of all users and stakeholders

School management requires balancing differing priorities, and even an ideal system will reflect compromises between the needs and priorities of the different users. In the case of low- and middle-income countries (LMICs), the government procurement of EMIS may be limited by:

- Internal technical capacity constraints and know-how across the government
- Limited funding for operationalisation and maintenance
- Limited software development skills
- Lack of user buy-in.

2. EMIS have had limited usefulness in informing decision-making, even when offering the required functionality for management

This is due to poorly integrated data structures, leading to:

- Fragmented, duplicated, or conflicting data sets
- Inaccurate data collected at school levels
- Lack of, or slow feedback loops for the data to inform decision-making
- Difficulty interpreting data in meaningful ways.

3. Technical and training requirements for all phases of EMIS integration, from scoping to maintenance, are not fully appreciated and supported

The cost of developing an EMIS as a piece of software is high, but the cost of integrating it into an educational system, and maintaining its use, is even higher. While there can be long-term cost savings associated with the successful integration of EMIS because they can reduce administrative burdens and streamline complicated systems, the short-term process of change management, which affects the entire system, requires buy-in from all stakeholders.

A key message

For EMIS to be effective and able to support evidence-based decision-making, a greater emphasis must be placed on:

- **Utility**—so that exactly the right data is collected for users at all levels of decision-making.
- **Usability**—so that key system users can easily input the necessary foundational data with minimal friction.

Currently, EMIS are generally regarded as technological data systems. However, given that data collected and stored in EMIS relates to people, communities, and societies, and the decisions made based on the data have profound social implications, we

need a shift that sees students, teachers, schools, and communities as central to an EMIS.

What we know about the topic

Donors have prioritised education sector analysis guidelines, which provide methods and tools for:

- Education planning
- Monitoring critical indicators (such as enrolment and attendance)
- Standardised assessments
- Household surveys
- Cost-effectiveness calculations
- Equity measurements
- System capacity analysis.[1, 2]

The World Bank's Systems Approach for Better Education Results (SABER) project produced the first framework for effective EMIS, outlining key system components, activities, and policy considerations.[3] The space has also grown with a number of data monitoring initiatives focusing on monitoring learning, attendance/absenteeism, and gender-based measurements (see Resources for curated lists).

The importance of education data has been further underscored by USAID's investment in a 12-year project on Education Data for Decision-Making (EdData II) in 2004, carried out by RTI.[4] The project contributed significantly to the field by developing standardised assessment instruments used widely today (e.g., EGRA and EGMA).[5] Data collection tools that can be used offline (e.g., Tangerine) to conduct interventions and action research and which centre monitoring and evaluation, have become the gold standard in systemic education interventions (e.g., early grade pilot interventions, followed by larger projects such as PRIMR and Tusome). Lessons from EdData II concluded that education data is underutilised due to:

- Lack of relevance and disaggregation
- Concerns of reliability and validity
- Limited quality assurance
- Lack of demand and accountability measures to promote data use
- Donor investments focusing on developing technological mechanisms but not instrumentalising using data for decision-making.[6]

Consolidating and building on various initiatives and lessons learnt, the EdTech Hub's position paper, A Case for a Systems Approach to EdTech, argued for and theorised a macro-level, holistic approach to implementing EdTech.[7] Such a systems approach goes beyond fragmented EdTech toolkits and dashboards to:

- Analysing the political economy[8]
- Mapping operating environments
- Understanding system complexity, non-linearity, and feedback loops
- Ensuring multi-level stakeholder engagement
- Promoting coordination between stakeholders at the human level and interoperability at the technological level
- Emphasising capacity building
- Supporting effective data collection and use.

In attempting to make a 'systems-thinking' approach more practical, particularly for education management, a number of approaches, guides, frameworks, and recommendations have emerged. The following section highlights these.

Key insights to improve practice

Building on the vision for the future possibilities of EMIS, two main dimensions emerge that capture the mindset shifts needed to go from EMIS as a tool for data collection, organisation, and static reporting to EMIS as a real-time system that translates data into meaningful and actionable evidence for decision-making across multi-level system actors. This requires a commitment to two key aspects of user experience design: utility and usability.

Optimising for utility

Optimising the system's utility ensures that key functions and processes account for the structural needs of everyone—from students and teachers to governmental decision-makers. To take a more systems approach to EMIS, multi-sector, multi-level stakeholders need to be incorporated into the system across various policy areas, including developing mechanisms for ensuring quality data; developing data storage, management, protection, regulation, and protocols; ensuring system soundness, and providing an enabling environment.

Optimising for usability

Optimising the system's usability requires streamlining users' interactions with the system so that perceived existing needs are addressed and barriers to ongoing use are minimised. While functions replaced by integrated EMIS were previously time-consuming, manual, and paper-based processes, they are now digital, automated, real-time, and interoperable, with a focus on linked data architecture. To leverage these advancements in technology, platforms need to be designed for contextually appropriate tools.

The following section identifies concrete, evidence-based recommendations for how to make EMIS useful and used more frequently.

Focus on the utility of an EMIS to identify structural needs

The first step to identifying the needs of stakeholders is to **map the education data system** to support multi-stakeholder coordination (between donors, development partners, international non-governmental organisations, government bodies, bureaus of statistics, and researchers) and avoid duplication and fragmentation. There are multiple mapping purposes. See Box 1 for the different areas that may need to be mapped.

Box 1. *Stakeholder needs that may need mapping.*

- The stakeholders in the education data ecosystem
- Different institutional/departmental needs
- Existing datasets and/or data indicators
- Research studies with secondary data
- Different policy/research gaps to which data is needed to respond.[9]

Some practical resources to better understand and guide mapping exercises include:

McBurnie, Chris, and Iman Beoku-Betts. 2021. 'Mapping the Education Data Ecosystem in Sierra Leone'. Working Paper. EdTech Hub. https://doi.org/10.53832/edtechhub.0068.

For methodology for mapping education data in sub-Saharan Africa:

Lawson, Laté, and Lucy Heady. 2021. 'Mapping Education Data in Sub-Saharan Africa'. Education Sub Saharan Africa (ESSA). https://essa-africa.org/sites/default/files/inline-files/Draft%20Mapping%20Methodology_Unlocking%20Data.pdf.

Selwaness, Irene, Taskeen Adam, Laté Lawson, and Lucy Heady. 2022. 'Guidance Note on Education Data Mapping in Sub-Saharan Africa: Moving from Theory to Practice'. Technical Report. EdTech Hub. https://doi.org/10.53832/edtechhub.0096.

This resource includes information barriers to accessing administrative data through the Malawi Open Data for Education Systems Analysis (MODESA) project:

Pambe, Rigobert, Esme Kadzamira, Renaldah Mjomba, Laté Lawson, Eldah Onsomu, Taskeen Adam, Lucy Heady, John Mugo, and Teg-Wendeldriss Tinto. 2021. 'Lessons Learnt from Education Data Mapping in Africa: Workshop Summary and Synthesis'. Technical Report. EdTech Hub. https://doi.org/10.53832/edtechhub.0052.

Incentivise data accuracy

Incentivise users to provide accurate data by ensuring they see the benefits of data collection and EMIS. End-users (e.g., local education officers, teachers, and school leaders) may sometimes submit data from previous years or create fake data sets.[10] When end-users see that their problems are being addressed timeously thanks to data being reported accurately, they will be encouraged to collect reliable data.[11] Both dissemination of findings from data collection and taking action based on these findings need to be prompt and easily digestible. This feedback loop is the ultimate goal: reliable data being used to address issues in the education system.

Quantitative and qualitative data

Complement aggregated education data with qualitative data to ensure that the best solution to address the problem is taken. Understanding the limits of aggregated education data is important to correctly interpreting a situation and choosing a course of action. Participatory approaches are useful for unpacking why a particular phenomenon (found through aggregated data) is taking place and ensuring that end-users are part of the decision-making process.[12] For example, in Sierra Leone, decision-makers plan to use geographic information systems (GIS) to design programmes that will attract teachers to remote areas. Qualitative research added valuable insights, for example, that the physical and working conditions of schools as well as opportunities for professional development, impacted teachers' school preferences more so than location.

Establish communities of practice

Establish several types of communities of practice to nurture the ecosystem, promote local ownership and create a broader sense of purpose.[13] The *education community* (from the ministry and district officials to principals, coaches, teachers, parents, and learners) needs to 'buy in' to the concept. To achieve this, user needs and preferences need to be met. **At a national level, governments (as opposed to development partners or donors) should own the platforms, source code, and data.** They also need to own the decision-making and design processes involved in developing EMIS systems—including managing cloud and domain hosting—to ensure platform sustainability.[14] To support local development and maintenance, *local developer communities* (e.g., the highly active DHIS2 HISP regional communities)[15] are useful and can be connected to global developer communities to stay up to date with the technologies, updates, and protocols. Similarly, engaging and nurturing *academic communities* (e.g., the Unlocking Data African education researcher community)[16] can support the analysis and use of data to respond to evidence and policy gaps.

Focus on usability for long-term engagement

To ensure optimal use, select the most appropriate tools for the context, not just in terms of function but also form. Box 2 below lists examples of tool selection criteria—the diversity of which

demonstrates the need to consider the perspective of multiple stakeholders rather than a simple tech procurement transaction.

Box 2. *Tool selection criteria for inclusion in an EMIS*

- Hardware and software requirements
- Supported modalities
- Connectivity and offline capabilities
- Interoperability
- Backward compatibility
- Adaptive capabilities
- Real-time/dynamic capabilities
- Costs and cost-effectiveness
- Licensing
- Functionalities
- Reliability
- Target environment
- Target population
- User-friendliness
- Design accessibility
- Digital literacy requirements
- Human resource requirements
- Language offerings

The following curated and categorised tool lists can assist in deciding which tools to use, depending on the need.

Koomar, Saalim, and Harriet Blest. 2020. 'Using EdTech to Support Effective Data Monitoring: A Curated Resource List.' Helpdesk Response 23. Cambridge, UK: EdTech Hub. https://doi.org/10.5281/zenodo.4762325. Available at https://docs.edtechhub.org/lib/FS4CMYUB.

Crowdsourcing Data Technologies for Education in Emergencies. See https://edtechhub.org/edtech-tools/ed-data-tools/. Retrieved 29 February 2024.

Crowdsourcing Data Technologies for Education in Emergencies. See https://edtechhub.org/edtech-tools/ed-data-tools/. Retrieved 29 February 2024.

FHI360 and USAID. 2021. 'Technologies for Data Collection, Processing and Communication in Education in Emergencies: Mapping Practices and Opportunities in the MENA Region and Globally'. https://www.edu-links.org/resources/technologies-data-collection-processing-and-communication-education-emergencies.

Gustafsson-Wright, Emily, Sarah Osborne, and Muskan Aggarwal. 2022. 'Digital Tools for Real-Time Data Collection in Education'. Washington D.C.: Brookings Institute. https://www.brookings.edu/articles/digital-tools-for-real-time-data-collection-in-education/.

Vijil, Alejandra, Yomna El-Serafy, Taskeen Adam, and Björn Haßler. Forthcoming. 'Data Collection and Visualisation Tools in the Education Sector in Sub-Saharan Africa and South Asia'. Helpdesk Response. EdTech Hub. https://doi.org/10.53832/edtechhub.0151.

Digital readiness

Ensure that the digital readiness of the ecosystem matches the requirements of the EMIS. The usability of a system should always accommodate the capacity of the users and surrounding support stakeholders. In the case of EMIS, a robust local support structure may require further training and capacity-building for some stakeholders to have differentiated, higher-order digital literacy skills and human capacity to manage the increasing complexity in the digitalisation of EMIS.[17] For EMIS to be sustainable, ministries of education need in-house capacity to understand how to implement, use, and maintain platforms effectively. Similarly, local software developers with specialist skills who can design platform components for interoperability and modularity are needed. With visions for school-level stakeholders to collect data digitally and use dashboards,

digital skills development is required at the school level.

Develop and use existing standards and architectures

Data standards and architectures are well established to account for reusability, interoperability, and sustainability. Any further work on EMIS should support these standards for better interoperability (e.g., application programming interfaces, plug-ins, microservices, modular design) so that different software and platforms can speak to each other.[18] Following such standards across sectors can result in an all-encompassing data management system. Policymakers proactively setting interoperability standards and protocols can ensure better communication between systems without forcing public or private partners to use a single platform. An example of such an architecture is the National Digital Education Architecture (NDEAR)[19] in India, which was developed out of many rounds of stakeholder engagement with the public and private sectors. Of course, competing standards that are not interoperable are inevitable. However, this should not lead to dismissing all standards, as this simply creates yet another competing framework.

Another way to support existing standards is to avoid building an EMIS from scratch. Building blocks (open source, modular, interoperable pieces of code or software that can be (re)used to build or tailor platforms) and off-the-shelf solutions exist for EMIS architecture. This means that less funding and time needs to be spent on developing a bespoke EMIS from scratch for each country, and more time and budget can be spent on building capacity to use the data for decision-making. As with EMIS development in general, the effective use of a building-blocks approach depends on a number of factors, including sufficient investment in human capacity and platform customisation, basic infrastructure maturity, professional development, and a supportive ecosystem and community.

Areas for further exploration

There are multiple questions that need ongoing work related to the issue of how EMIS can be made as effective as possible. This brief highlights four questions that are particularly pertinent for consideration by decision-makers.

How can EMIS funding be made more sustainable?

As outlined above, many EMIS interventions become unsustainable when donor funding is depleted. A replicable and sustainable solution to this challenge has yet to be found, especially with limited national education budgets. Funding issues can be as simple as lack of funding to host an EMIS platform in the long term, or the loss of key trained personnel who can no longer be paid. Currently, it is common for donors to provide short-term funding for maintenance and technological support, such as cloud hosting. This time period is often insufficient for countries to find alternative funding sources, and means these platforms are prone to collapse. Even when a technological system is up and running, there is limited financing to support the human actors in the system. Additionally, funding is needed not just for general management and maintenance but also for tinkering and innovating, developing home-grown solutions, engaging and sharing tools and resources with others, and retaining key trained personnel. More secure and sustainable financial support mechanisms need to be established to resource these activities if we are to see more effective widespread use of EMIS in LMICs.

How can dashboards be designed for effective use?

While dashboards provide key insights, there are many factors to consider if their potential value is to be realised, such as appropriate design and level of information for the intended user, as well as the users' ability to interpret the information provided. Education stakeholders often require more training to optimise the use of data from such dashboards, and without this, data is subject to distortions and misinterpretation. Highlighting the risks of dashboards at a school level, Pritchett[20] illustrates that a core problem is the lack of understanding of what actions are needed to respond to available data, rather than a lack of data itself. Dashboard designers need to build in feedback features to assist users in taking the next step based on the data provided.

Examples are tools like Tangerine:Teach and Tangerine:Coach,[21] which help teachers/coaches interpret data and guide on what feedback could be given. Increasing the capacity of systems to interpret data is as important as designing dashboards and feedback mechanisms in ways that respond to the needs and capacity of users.

How can information systems be integrated across sectors?

As data architectures and protocols are set in place, and more integrated approaches are used to set protocols and standards, further opportunities arise for integration across sectoral information systems. For example, there are great benefits to linking education, health, and employment management systems and social protection systems. This is already the case with DHIS2 and DHIS227 for education[22] in various countries, such as with the Ugandan school immunisation campaign.[23] It is often easier for a system to expand within a country from one sector to another. This is because trust in a product and political buy-in are essential. Government departments, therefore, need to explore how best to collaborate on cross-sectoral, whole-of-government data management information systems to unlock the next frontier of data for decision-making.

Resources

These resources unpack systemic approaches to education management:

- Coflan, Caitlin, Natalie Wyss, Sangay Thinley, and Mark Roland. 2022. 'Developing a National EdTech Strategy'. Working Paper. EdTech Hub. https://doi.org/10.53832/edtechhub.0142.
- Adam, Taskeen, Yomna El-Serafy, Marius Podea, and Björn Haßler. 2021. 'The Use of "Building Blocks" to Develop Digital Platforms for Education in Sub-Saharan Africa'. EdTech Hub. https://doi.org/10.53832/edtechhub.0049.
- EdTech Team. 2022. 'Knowledge Pack: EMIS 2.0: Learning And Accountability System Architecture (LASA)'. Washington D.C.: World Bank Group. https://documents1.worldbank.org/curated/en/099615004222210401/pdf/P1742520215 19b01d0bd3e06adc9dd28d86.pdf

These resources capture processes of using data for decision-making in Sierra Leone, including stakeholder mapping, teacher allocation, school quality assurance, and teacher stakeholder engagement:

- Beoku-Betts, Iman and Leh Wi Lan. 2023. 'Investigating the Activity Levels of School Quality Assurance Officers in Sierra Leone'. Working Paper 51. EdTech Hub. https://doi.org/10.53832/edtechhub.0154.
- McBurnie, Chris, Iman Beoku-Betts, Daniel Waistell, and Michael Nallo. 2021. 'Advancing Data-Driven Decision-Making for School Improvement: Findings from the One Tablet Per School User Testing Programme in Sierra Leone'. Working paper. MBSSE, EdTech Hub, Leh Wi Lan. https://doi.org/10.53832/edtechhub.0066.
- This resource includes details of and links to several reports on the research project *The Impact of GIS-Supported Teacher Allocation in Sierra Leone*
- Haßler, Björn, Chris McBurnie, and Iman Beoku-Betts. 2023. 'Outputs Register: The Impact of GIS-Supported Teacher Allocation in Sierra Leone'. EdTech Hub. https://doi.org/10.53832/edtechhub.0164.
- See also https://edtechhub.org/evidence/edtech-hub-research-portfolio/impact-of-gis-supported-teacher-allocation-sierra-leone/. Retrieved 5 March 2024.

These resources provide curated and categorised tool lists that can assist in deciding which tools to use, depending on the need:

- Koomar, Saalim, and Harriet Blest. 2020. 'Using EdTech to Support Effective Data Monitoring: A Curated Resource List.' Helpdesk Response 23. Cambridge, UK: EdTech Hub. https://doi.org/10.5281/zenodo.4762325.
- Crowdsourcing Data Technologies for Education in Emergencies. See https://edtechhub.org/edtech-tools/ed-data-tools/ Retrieved 29 February 2024.
- FHI360 and USAID. 2021. 'Technologies for Data Collection, Processing and Communication in Education in Emergencies: Mapping Practices and Opportunities in the MENA Region and Globally'. https://www.edu-links.org/resources/technologies-data-collection-processing-and-communication-education-emergencies.

- Gustafsson-Wright, Emily, Sarah Osborne, and Muskan Aggarwal. 2022. 'Digital Tools for Real-Time Data Collection in Education'. Washington D.C.: Brookings Institute. https://www.brookings.edu/articles/digital-tools-for-real-time-data-collection-in-education/.
- Vijil, Alejandra, Yomna El-Serafy, Taskeen Adam, and Björn Haßler. Forthcoming. 'Data Collection and Visualisation Tools in the Education Sector in Sub-Saharan Africa and South Asia'. Helpdesk Response. EdTech Hub. https://doi.org/10.53832/edtechhub.0151.

These resources cover different mapping processes and guidelines:

- McBurnie, Chris, and Iman Beoku-Betts. 2021. 'Mapping the Education Data Ecosystem in Sierra Leone'. Working Paper. EdTech Hub. https://doi.org/10.53832/edtechhub.0068.
- Lawson, Laté, and Lucy Heady. 2021. 'Mapping Education Data in Sub-Saharan Africa'. Education Sub Saharan Africa (ESSA). https://essa-africa.org/sites/default/files/inline-files/Draft%20Mapping%20Methodology_Unlocking%20Data.pdf.
- Selwaness, Irene, Taskeen Adam, Laté Lawson, and Lucy Heady. 2022. 'Guidance Note on Education Data Mapping in Sub-Saharan Africa: Moving from Theory to Practice'. Technical Report. EdTech Hub. https://doi.org/10.53832/edtechhub.0096.

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6. Mulcahy-Dunn, Dick, Crouch, and Newton. 'Education'.
7. Bapna, Akanksha, Susan Nicolai, Christina Myers, Arnaldo Pellini, Namrata Sharma, and Sam Wilson. 2021. 'A Case for a Systems Approach to EdTech'. EdTech Hub. https://doi.org/10.5281/zenodo.5651995. Available at https://docs.edtechhub.org/lib//UR6CQL9K.
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12. Koomar, Saalim. 2024. 'How Can Participatory Methods Centre Teachers Within Education Policy?' Learning Brief. EdTech Hub. https://doi.org/10.53832/edtechhub.1005.
13. Adam, El-Serafy, Podea, and Haßler. 'The use'.
14. Messa, Angele, Saalim Koomar, and Joel Mitchell. 2022. 'Livrable 4: Note de Conseils Sur La Plateforme Numérique'. Technical Report. EdTech Hub. https://doi.org/10.5281/zenodo.7303773. Available at https://docs.edtechhub.org/lib/RMJK6G6Q.
15. See https://dhis2.org/hisp-network/. Retrieved 16 November 2023.
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