Re-imagining the future of Education Management Information Systems

“Beyond head counts: Leveraging data systems to support inclusive and effective learning for all.”

Working paper V.1
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Acknowledgments

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Introduction

Faced with rapidly evolving school and digital environments, Education Management Information Systems (EMIS) have experienced significant change in the recent past. The pace of this evolution has differed around the world, resulting in a lack of international consensus concerning the expected functions and capabilities of EMIS (Abdul-Hamid et al., 2017). It is universally clear, however, that ministries must move EMIS beyond head counts and routine administrative tasks.

Three factors have recently raised the bar on the expectations of EMIS: (1) the growing complexity of educational systems, (2) national and international SDGs monitoring requirements, and (3) the increasing need for real-time data and for EMIS to support learning, including in times of crisis. Educational ecosystems have expanded in scope, encompassing education delivery by various stakeholders, including non-state actors, along a lifelong and life-wide learning continuum throughout early childhood, primary, secondary, technical and vocational, higher education, and adult/continuing learning across formal, non-formal and informal learning settings. Education institutions around the world are increasingly expected to answer questions not only about enrolment and performance, but also about the well-being, teaching and learning processes, learning outcomes, pathways, diversity, equity, inclusion, and the long-term outcomes of all students. Moreover, EMIS must support learning continuity and monitoring even in the event of a crisis in order to plan for and facilitate continuous access to quality education to all.

The high bar for EMIS in today’s educational landscape poses complex challenges to Ministries of Education around the world. However, some countries have met this bar by transforming the crisis challenges into opportunities to enhance EMIS for better education and learning management. The 2021 Seminar on the futures of EMIS will share stories of these challenges and discuss the opportunities for data system hybridization, digitization, integration, and optimization with frontier technologies.

This seminar paper will examine the limitations of past and current conceptions of EMIS through the lens of the present COVID-19 crisis in order to stimulate discussion and preparation for more resilient, integrated, innovative futures of EMIS. The paper is divided into four chapters.

- **Section 1** sets forth the context surrounding the expected functions of EMIS in education and explores the changing capabilities of EMIS in the age of Big Data and real-time information flows.
- **Section 2** outlines EMIS challenges and priorities for further consideration, followed by an examination of COVID-19’s exposure and exacerbation of these challenges.
- **Section 3** explores critical capacities and consideration to prioritize when shaping the futures of EMIS.
- **Section 4** presents discussion points for UNESCO’s International EMIS Seminar (26-28 May 2021). They include: (1) the key standards, principles and values of future EMIS; and (2) establishing an international community of practice to support envisioning and operationalization of future EMIS.
Section 1 Background and Context

In 2018, UNESCO and GPE hosted an international seminar that explored the major trends driving the evolution of EMIS. Key challenges across different countries and contexts were discussed, including the increasing demands for data, with a focus on monitoring SDG4 targets. The publication that was issued as a result of the 2018 seminar identified six factors driving the evolution of EMIS, as seen in Figure 1.

**Figure 1. Factors driving the evolution of EMIS.**

![Factors driving the evolution of EMIS](image)

*Note: Compiled from UNESCO and GPE’s 2018 International EMIS Seminar working paper.*

For the second international EMIS seminar, two additional factors have been identified, which necessitate a re-imagination of the roles and responsibilities of EMIS: real-time data and learning facilitation in the face of schooling disruption and in the era of Big Data, as highlighted by the COVID-19 pandemic.

These two factors have brought to the global attention the need to enhance EMIS in view of adapting them to effectively inform education planning and learning management in rapidly changing contexts, where the education services may move away from the traditional learning environment and educational institutions, especially in most vulnerable contexts, may encounter increased barriers to ensure continuity of learning and monitor quality and safe education for all.

**Demand for Data**

Recently, the data landscape has changed dramatically, and with it, the expectations of EMIS. The education giant Pearson provocatively claimed in 2018 that “increasingly, data will be the foundation of the education landscape” (Deegan & Nathan, 2018, p. 61). Reliable, accurate data are the lifeblood of every management information system. Fischer et al. (2020) review the challenges and affordances of data in recent decades, claiming that “the increased availability of big data has led to new frontiers in how we monitor, understand, and evaluate processes in educational contexts and has informed decision making and efforts to improve educational effectiveness” (p. 131). Data and information enable the evidence-based decision making that is necessary to increase the coordination, accountability, and equitability of increasingly complex education systems.

Data is valuable to every actor at each level of an education system: from the student who seeks information about their academic performance, to the school director who monitors teacher professional development, to the planning officer who tracks progress toward objective targets. Today, data is predominantly digitized, leading Ozga (2015) to claim that “the generation, accumulation, processing and analysis of digital data is understood transnationally, nationally and
institutionally as a solution to problems of schooling” (p. 70). Without easy access to understandable and timely information, stakeholders are left in the dark to make decisions without supporting data. Today, with an abundance of accessible information and ever-expanding global networks, new orders of magnitude in data capture, search, sharing, storage, analysis and presentation have emerged. “With more data comes more noise” (Prinsloo, 2015, p. 296), and increasingly, EMIS is expected not only to capture and process, but also to aggregate data from all levels of the education system.

**Call for Crisis Resilience**

The COVID-19 pandemic added a new dimension of complexity to an already complex educational environment. In their efforts to deploy distance and hybrid learning programmes, many education systems and their EMIS were unprepared to reach beyond the walls of the school building to support teaching, learning and monitoring during school closures. The pandemic triggered an unprecedented convergence of education building blocks and social systems, blurring the lines between the responsibilities of different sectors’ information systems (e.g., learning, health, labour market and social security). The need for an integrated EMIS, both vertically across levels of the education system and horizontally across education departments and social sectors, is more apparent now than ever before.

A working definition of successful EMIS has multiple components, captured in Figure 2.

**Figure 2. Defining a Robust EMIS for 2021.**

![Diagram of a Robust EMIS](image)

*Note:* Four components of the working definition of EMIS, adapted from (UNESCO, 2008; UNESCO, 2018).

The pandemic was a wakeup call to existing holes and misalignments that make many EMIS unprepared to continuously inform effective education management and support learning, even in the event of an emergency or crisis. Now, with an international spotlight on EMIS, it is high time to take action to develop an international community of EMIS practice that engages in reimagining the future EMIS to ensure continuity of teaching and learning, inclusion and equity in education, the timely collection of data on vulnerable and marginalized learners, and eventually the improvement of learning outcomes for all.

The next section of this paper will outline common EMIS challenges, priorities for improvement, and the effects of these challenges on education planning and management as revealed by the COVID-19 crisis.
Section 2 EMIS Challenges and Priorities for Action

Before the COVID-19 pandemic, challenges faced by many countries have been widely documented (e.g., World Bank, 2015, UNESCO & GPE, 2020, UNESCO-UIS, 2020, UNESCO, 2021). These challenges and priorities may be summarized as below.

### Policy Framework

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Priorities</th>
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<tbody>
<tr>
<td>Limited policy, institutional and legal frameworks that are susceptible</td>
<td>Develop a strong legal or policy framework to mandate EMIS</td>
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<tr>
<td>to leadership changes</td>
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<tr>
<td>Limited political will to sustain the system and ensure financial</td>
<td>Cultivate a culture of data-informed decision making to build</td>
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<td>autonomy for its maintenance</td>
<td>sector-wide resilience</td>
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<td>Insufficient sustainable planning and budgeting for EMIS, leading to</td>
<td>Fund EMIS from an institutional level in order to enhance</td>
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<td>inadequate funding for IT infrastructure &amp; equipment</td>
<td>human, technical, and infrastructural capacity and</td>
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<td></td>
<td>sustainability</td>
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<tr>
<td>Unclear EMIS vision and limited support of data utilization for decision</td>
<td>Enable data sharing between EMIS and data collection divisions both</td>
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<tr>
<td>making</td>
<td>within and outside the education sector</td>
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### IT Capacities and Platforms

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Priorities</th>
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<tbody>
<tr>
<td>Weak technical infrastructure (i.e. limited Internet connectivity slows</td>
<td>Use offline methods of data collection in areas with limited Internet</td>
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<tr>
<td>down their data collection, analysis, and reporting cycle)</td>
<td>connectivity and then upload data online in central offices where</td>
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<td></td>
<td>Internet connectivity is more stable</td>
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<tr>
<td>Fragmented and disconnected databases with weak data sharing</td>
<td>Hybridize existing communication infrastructure, e.g. mobile</td>
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<tr>
<td>protocols or sound statistical methodologies and documentations</td>
<td>phones, to make a 'cohabitation of technologies' with data integration</td>
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<td></td>
<td>protocols and infrastructure</td>
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### Human, Institutional, and Organizational Capacities

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Priorities</th>
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<tbody>
<tr>
<td>Developing human, and institutional capacities by sensitizing, skillin</td>
<td>Apply a capacity-building approach for system sustainability and</td>
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<td>ging, motivating and properly supporting staff, particularly in</td>
<td>institutionalization</td>
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<tr>
<td>analytical training and computer skills training</td>
<td></td>
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<tr>
<td>Turnover of skilled and trained country staff</td>
<td></td>
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<tr>
<td>Over-dependence on external consultants and facilitate the</td>
<td>Increase buy-in and access particularly at the school level in order to</td>
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<tr>
<td>institutionalization of EMIS</td>
<td>show the links between what data personnel are reporting and reviewing</td>
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<td></td>
<td>and improved quality in the education system</td>
</tr>
<tr>
<td>Lack of school, student and teacher IDs, leading to fragmented &amp;</td>
<td>Establish common data standards and reporting templates for all levels</td>
</tr>
<tr>
<td>disconnected databases</td>
<td>in the education system, in order to harmonize education data coming from</td>
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<td></td>
<td>decentralized units and facilitate cross-country benchmarking and</td>
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<td></td>
<td>sharing of practices</td>
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COVID-19 Exposes the Limitations of EMIS in Many Education Systems

The COVID-19 crisis highlighted the shortcomings and challenges of EMIS to help governments ensure the continuous management and monitoring of learning for all, inclusion and equity. Education data and indicators are needed for immediate use to monitor and respond to the constantly evolving situations. Often, EMIS was not suited for this purpose. The effects of these challenges on EMIS can be organized around four dimensions of data quality: (1) timeliness, (2) relevance and completeness, (3) accessibility and use, and (4) interoperability and adaptability.

- **Data Timeliness:**
  Many existing EMIS lack the ability to capture real-time data on schools, students and teachers. The COVID-19 crisis revealed that this affects the ability of authorities to effectively and efficiently decide on school closures, shifts to distance/hybrid learning, determine dropout risk, plan to prevent learning loss, and encourage the safe return to schools. Many countries struggled to respond to urgent educational needs, as data from EMIS often suffer from a significant time lag and are not updated sufficiently over the course of an academic year.

- **Data relevance and completeness:**
  Monitoring students who are not within school walls was one of the key data challenges faced by most countries during COVID-19. Even prior to the pandemic, EMIS struggled to provide data on all children, especially underserved populations like displaced learners, out-of-school children, or children with disabilities. The pandemic required EMIS to extend monitoring beyond the school walls, but most EMIS were not originally designed to collect data from other settings like the household. As such, many EMIS did not possess the agility or adaptability to respond to the new demands on data brought on by the pandemic.

While EMIS cannot be expected to produce data on everything due to the cost and capacity requirements of data collection, EMIS should identify and monitor, more than ever, student and teacher capacity to participate in alternative distance education programmes, including digital, TV, radio, and paper-based platforms. EMIS must be dynamic and agile enough to quickly evolve and address new data demands as they become relevant, enabling equitable...
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educational planning by including the most vulnerable learners in data collection.

- **Data availability and use:**
  Due to lack of a strong and open data culture coupled with weak data literacy, many EMIS did not include mechanisms to disseminate data back to data providers (including schools, parents and communities) in frequent, user-friendly ways. The pandemic revealed the need for a culture of data-informed decision making at all levels of the education system. Many systems could not effectively implement and monitor crisis responses due to weak use and accessibility of data, coupled with a lack of capacity for data analysis. Collecting data for education indicators amid the crisis is very difficult. Teachers may not be able to report attendance in the same way as they did under normal conditions; students may not have access to the same tools used by the school system to deliver daily lessons and homework; and teachers may not possess the same skills to navigate the different platforms used in education delivery. **Non-traditional methods** of data collection may be needed for the sake of expediency. Under crisis, EMIS may have to focus on only a few key data and indicators that are deemed essential and collect data from samples of the school and student populations instead of the entire education system in a rapid collection format. The negative economic impact of the COVID-19 crisis may have forced teachers to leave the profession, move to other places or stop teaching to take care of family members. School closure also increases probabilities of student drop out due to pressures on family income – often in combination with low quality of distance education - students of working age may be joining the labour force to help the family cope financially. Learning disruption is predicted to be most severe among students living in poverty, in areas with little access to online education and those with learning disabilities. These are the scenarios that can describe the possible changes in education that need documenting by EMIS, where oversampling of vulnerable students can be used to monitor equity when considering a sampled data collection discussed above.

- **Data beyond school census:**
  Prior to the pandemic, few EMIS incorporated other sources of educational data beyond school census data, such as learning monitoring, household surveys, inspection reports, school observation checklists, learning assessments, finance data, Human Resources, and more.
  In addition, in COVID-19 responses, coordination and linkages with other data systems, such as health, are critically important. The data from the health sector need to be communicated to the education sector immediately so that the decisions can be made based on the latest public health information. In addition, in some countries, the disruption of education may entail the interruption of essential health, nutrition, social and protection services that can put significant and irreversible strain on the well-being of learners and their families, thus increasing the risk of the most vulnerable learners to abandon education and resort to negative coping mechanisms (UNESCO, 2021). This issue becomes even more relevant when referring to the educational and social exclusion of the most marginalized groups, such as girls, out-of-school children, learners affected by displacement and disabilities.

  The lack of interoperability and data sharing protocols and mechanisms across stakeholders dealing with related aspects of the education sector makes it challenging to readily identify and address the comprehensive risks and barriers to access education and gain positive learning outcomes of the most vulnerable children and youth.
Section 3 Futures of EMIS: Considerations and Critical Conversations

While the COVID-19 pandemic has shed light on the limitations and obsolescence of many information systems, it has also highlighted the untapped potential of enhanced information systems that can inform effective education planning and management at all times, even in the event of an emergency and subsequent recovery. Interventions must concern both low and no-tech education data systems, as well as more sophisticated EMIS that may benefit from frontier technologies and connectivity, often enabled through public-private partnerships. COVID-19 emphasized the urgency of narrowing global digital divides in education and ensuring connectivity to all, not only through schools.

Throughout all efforts aimed to reflect on what the future ideal EMIS could look like, ensuring that data collected are harmonized, rationalized and utilized by all stakeholders involved in their production and ultimately translated into adapted and resilient actions that ensure access to quality and safe education for all needs to be the collective goal.

Leveraging frontier technologies for future EMIS

The increased investment in data and technology in response to the COVID-19 pandemic could accelerate the transformation of EMIS. Globally, there is a growing interest in digitizing government services, including education. From the management of schools to that of central administration, from teaching practices in the classroom to learning assessment, digitization has the potential not only to dramatically improve the management of the education system but also to generate the mass of big data that advance data analytics rely on. E-governance requires data consolidation and coordination of service delivery across government agencies and functions. Integrating of EMIS within larger government digital ecosystems is a critical step in the digital transformation of the education sector.

Considering the digitization of and digital transformation of the public sector more broadly requires critical conversations in the following domains:

<table>
<thead>
<tr>
<th>Domains</th>
<th>Areas of consideration and further discussion</th>
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<tbody>
<tr>
<td>Policy framework</td>
<td>• Sound policy and legal framework for digitalization/digital transformation of education sector, in line with the overall government digital strategy</td>
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<tr>
<td></td>
<td>• Culture of data-informed decision making</td>
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<td></td>
<td>• Adequate and sustainable funding to ensure policy implementation</td>
</tr>
<tr>
<td>IT capacity and platforms</td>
<td>• Roadmap for equitable and inclusive digitalization, especially in developing countries</td>
</tr>
<tr>
<td>Human, institutional and organizational capacities</td>
<td>• Further capacity development in line with the requirements of future EMIS (e.g., database management, cloud-based computing, data literacy and advanced data analytics, etc.)</td>
</tr>
<tr>
<td></td>
<td>• Developing local ecosystem(s) for interoperability and sustainability</td>
</tr>
<tr>
<td>Data processes</td>
<td>• Use of unique student, teacher IDs and harmonized methods and standards that enable interoperability</td>
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<table>
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<tr>
<th>and connectedness</th>
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<tbody>
<tr>
<td>• Integration of data with non-education sectors</td>
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<tr>
<td>• Automated data collection, validation, analysis</td>
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With these domains in mind, Giga Initiative, established by UNICEF and ITU, aims at connecting all schools to the internet in partnership with the private sector. The Global Education Coalition, coordinated and facilitated by UNESCO, also launched a global connectivity initiative to ensure universal connectivity by fostering partnership. Such investment for increased connectivity and devices, powered by frontier technologies, will give much needed push to transform EMIS in many countries into an integrated sector-wide EMIS (see above figure 3 as an example).

The COVID-19 crisis presented the untapped potential of technologies that can transform EMIS into more elaborate information AND management systems. Data systems that can track each individual in the education system, rather than collecting headcounts at school level, showed their value during the crisis. As an integrated system with powerful analytics that supports real-time, data-driven decision making at all levels of education from day-to-day management operations to strategic planning functions, such EMIS are paving the way for what could be the futures of EMIS.

Below, some of the key frontier technologies that could transform EMIS are reviewed. These are not exhaustive, and this section will be enriched based on the discussions of the EMIS seminar.

**Big Data and EMIS**

The era of Big Data is marked by an abundance of accessible information and ever-expanding global digital networks. Big Data refer to “the capacity to search, aggregate and cross-reference large data sets” (Boyd & Crawford, 2012, p. 663). In the educational context, the National Academy of Education (2017) states that “big data typically take the form of administrative data and learning process data” (p. 4); however, in the context of the COVID-19 pandemic, this scope is even greater. Today, EMIS must be up to the task of capturing and creating aggregated, actionable information from massive amounts of disaggregated data across all levels of the education system and even outside the education sector. Connecting administrative data with learning process data, for example, can “unveil nuances about educational inequities and inform actions in faster feedback cycles” (Fischer et al., 2020, p. 132) that improve the inclusivity and effectiveness of education programmes.

Making sense of Big Data offers many affordances to education planning and management, in particular to understanding the mechanisms and effects of specific policies. An EMIS that can process Big Data also enables more comprehensive reform tracking, both of global indicators such as SDG4 and domestic goals. Open access to big data can increase equity by enabling all education stakeholders, including the general public, to evaluate the performance of educational systems and their impact on diverse students by monitoring inequalities (Fischer et al., 2020). Clayton and Halliday (2017) review how the democratization of big data can be used to identify and monitor equitable educational provision and outcomes.

However, transforming Big Data into information and knowledge is not without its challenges: human, technical, and ethical. Many EMIS still rely on considerable human effort for data collection and data processing. The increasing volume of information captured by educational organizations requires quick and continuous transformation of technical infrastructures, as well as political, legal, financial, and institutional frameworks that enable sound and sustainable data flows within and across sectors. In the context of distance learning, Prinsloo (2015) writes that, “We accept that harvesting more and different data may hold potential, but if we do not think critically about
institutional support and operational integration with regard to the harvesting and analysis of data, we may never realize the potential of bigger data” (p. 286). Privacy concerns have reached new heights as education stakeholders are forced to navigate between public interest, personal privacy, and commercial platform providers who limit or block access to their data (Fischer et al., 2020).

The high-speed processing requirements of unprecedented amount of data during the COVID-19 era also shed the light on the limitation of traditional data analytics approaches found in many EMIS. The growing variety and amount of data collected requires new strategies and techniques by which the data is captured, stored, processed, analyzed, and visualized. While EMIS reporting functions have been often limited to the release of statistical yearbooks, the Big Data era opens a large range of new possibilities in the area of data analytics, as well as new challenges. Fluid and responsive data pipelines need to be connected to sophisticated data analytics platforms to serve the information needs of an ever-increasing variety of stakeholders. In the United Arab Emirates (UAE), the Ministry of Education rolled out an advanced data analytics platform with over 1,200 schools and over 70 higher education institutions, totaling over 1.2 million students. This data analytics system reports on curricula, teachers’ professional development, learning resources, financing, operations, performance reports, teacher, student and parent feedback, and scores from international assessments like PISA and TIMSS.

AI and EMIS

Artificial Intelligence (AI) is one of the most talked about frontier technologies that has significant impact on society as a whole, including education. Some countries and education systems are already moving ahead. Many states and districts in the United States are using AI-powered early warning systems to predict and prevent dropouts (Vincent-Lancrin, S. and R. van der Vlies, 2020). The Republic of Korea has developed various data analysis tools using prediction techniques such as machine learning and deep learning. The United Arab Emirates (UAE) established a data analytics section in its Ministry of Education, dedicated to developing machine learning algorithms in support of strategic studies on the country’s education system.

With more and more data becoming available for and from education, use of AI in education is expected to increase across the globe. In this context, UNESCO organized an international conference on artificial intelligence and education in Beijing, China in 2019. The conference produced the first-ever document to offer guidance and recommendations on how best to harness AI technologies for achieving the Education 2030 Agenda, Beijing Consensus on Artificial Intelligence and Education. The Consensus calls for integration and/or development of AI technologies and tools for EMIS in order to make education management and provision more equitable, inclusive, open and personalized (p5). At the same time, the Consensus emphasizes the importance of developing AI applications in education that are free from gender bias and to ensuring that the data used for AI development are gender sensitive (p8). In addition, the Consensus has a dedicated section on ethical use of education data and algorithms, highlighting the key challenges including: (1) biased AI; (2) balance between open access and privacy; (3) legal and ethical risks. The Consensus also calls for further research and regulatory frameworks.

Also in 2019, UNESCO published a working paper titled “Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development”. Analyzing existing research and country cases, the paper identifies the following six major challenges and policy implications of introducing AI in education and preparing students for an AI-powered future(s).

1. Developing a comprehensive view of public policy on AI for sustainable development
2. Ensuring inclusion and equity for AI in education
3. Preparing teachers for an AI-powered education
4. Developing quality and inclusive data systems
5. Enhancing research on AI in education
6. Dealing with ethics and transparency in data collection, use and dissemination
Although all these six challenges are relevant to EMIS, the working paper gives special attention to the specific challenges of integrating AI to EMIS (the fourth challenge). In order to address the challenges, the recommendations of the working paper include:

- Make educational data open and usable at the school level
- Enable EMIS to generate analyses that are granular enough to help teachers and education administrators understand the key challenges while also being able to aggregate data to reveal trends that can inform policy development
- Ensure that data are complete and account for inequities (e.g., disabilities, refugees & IDPs)
- Integrate EMIS to other data sources such as household surveys and data from other ministries
- Where data systems are weak or incomplete, countries should focus on strengthening their data systems and bridging their data gaps
- Be mindful about cost of investment and pay sufficient attention to institutional and organizational capacities of using AI, rather than focusing on procurement of more sophisticated data reporting technologies

In 2021, UNESCO issued “AI and Education: Guidance for Policy Makers” aiming at supporting education policy makers better understand the possibilities and implications of AI for teaching and learning, and therefore make informed decisions. This comprehensive guidance document also has a dedicated section for EMIS, with the below key recommendations.

- Explore how AI technologies can improve EMIS
- Enable the holistic transformation of EMIS and their integration with learning management systems (LMS)
- Empower managers, teachers and students to promote the application of AI-powered EMIS and LMS

This guidance document also calls for the provision of low-cost models for developing AI technologies and for assurance that the interests of developing countries are fully represented in key debates and decisions. It also emphasizes the importance of creating a “bridge” between developing countries and countries with advance AI implementation.

**Blockchain and EMIS**

Blockchain technology can be used in many ways that can enhance EMIS, including: creating and managing unique IDs for learners and teachers; tracing of resources; managing students transfer between schools; facilitating teacher deployment; and tracking service delivery. Also, blockchain technology can make records more resilient, as they will be protected from physical destructions (e.g., natural disasters, conflicts) that may destroy many other record keeping systems.

In addition, with blockchain technology, digital, portable, verifiable lifelong credentials will be available for individuals. This is particularly important and useful in case of cross-border education, which is expected to continue growing despite the temporary halt due to the travel restrictions caused by COVID-19. It is also considered that such digital credentials can facilitate lifelong learning, where individual learning paths are becoming more diverse and less linear. In addition, blockchain technology is often cited as a possible technological ‘fix’ for privacy and security concerns surrounding learning credentials and other educational records to give individuals more ownership and control of their own data.

**Estonia** is one of the pioneers in this area, having been using blockchain technology in their data systems since 2008. Using blockchain technology, the European Commission developed Europass, a cross-country digital credentials infrastructure to make recognition of credentials such as qualifications and degrees across Europe more efficient and secure. A core component of Ethiopia’s Digital Transformation Strategy, Digital Ethiopia 2025, is its partnership with IOHK, a
global blockchain research and development company. Using a blockchain-based ID system, Ethiopia aims to give its 5 million students, 3,500 schools, and 750,000 teachers unique records in order to verify performance, personalize learning, and ultimately boost national education achievement and employment through data-driven planning (Parkin, 2021).

Integrating non-education data (e.g., geospatial data, climate hazards, public health, etc.) with EMIS

As stated above, prior to the pandemic, few EMIS incorporated other sources of educational data beyond school census data. Today, existing technologies and recent progress in advanced computational techniques have the potential to allow for an even greater and more beneficial use of EMIS beyond education data. For example, in the context of climate change adaptation and mitigation efforts and disaster risk reduction through and in education, it is indispensable to make use of non-educational data such earth observation and geospatial data, climate hazards data, population movements, social media data, public health data, etc. This has the potential to not only allow for richer and more advanced analysis, especially for predicting, preventing and responding to disasters such as pandemics, but also to allow for more integrated and effective collaboration between the education sector and other line ministries. The future of EMIS will therefore involve the integration of EMIS with data from other disparate sources (such as those mentioned above) and formats (including images, texts, etc.). For this to become a reality however, digital connectivity, data sharing mechanisms and protocols need to be put in place, in addition to strengthened IT and staffing capacities. The good news is that this is now more feasible than ever, mainly due the emergence of open source software solutions and training coupled with relatively reduced cost related to digitalization, cloud-based data management and computing.

Enabling effective EMIS beyond high-tech solutions

While many interventions aimed at enhancing EMIS focus on increasing the number and granularity of indicators or upgrading of technology, concerns around the heavy investment requirements associated with increasingly sophisticated EMIS, and the extent to which data efforts may be donor- or project-driven have been observed.

In light of the lessons learned from the COVID-19 crisis and other emergencies, approaches must be comprehensive and should include strengthening the capacities of Education systems to adapt, sustain and use EMIS beyond the intensive upgrade of digital technology. They should include:

- Strengthening and linking legal, policy and institutional frameworks around EMIS, therefore clarifying institutional priorities, commitments, roles and responsibilities within and across relevant ministries. This aspect should include accountabilities for crisis-relevant data collection and use that are aligned with national data policies and EMIS frameworks, and that consider legal protections related to data sharing, privacy and security

- Increasing data coordination within ministries of education, across ministries and partners at all levels with shared responsibility for education sector as well as the social welfare and health of its learners and educators. The COVID-19 crisis highlighted the critical importance of quality real-time data and the need for integration and interoperability of EMIS with other management information systems (MISs), especially with Health and Social Security MISs.

- Considerations of protection, privacy and security concerns must be at the core of efforts aimed to increase the sharing, availability and accessibility of data to promote accountability and feedback loops while protecting the best of interest and safety of communities.
Capacity-building on crisis-sensitive sector analysis, policy and planning is a key aspect of strengthening EMIS. This is necessary for ensuring a comprehensive understanding of educational vulnerabilities, risks and possible impacts in the event of an emergency that can guide the design, collection, analysis and use of relevant data.

Review data collection and processing tools and customised solutions that might help to improve the timeliness and coverage of data collection, accompanied by training and support to facilitate their use. However, a clear understanding of the context, assessment of user needs, analysis of risks, review of existing technology and considerations of cost effectiveness and sustainability should be the starting point.

Data accuracy and reliability rely on a thorough understanding and documentation of the process and purpose of data collection and of the definitions and terms used among data providers and collectors; this requires training and understanding down to the level of head teachers and teachers providing and using data at schools and in classrooms.

Recognizing flexible learning models, as COVID-19 has shown that education can take place anywhere (e.g. home by using technologies) and schools are no longer the only ‘reliable’ sources of enrolment and teacher data. It was thought that EMIS data originates from schools and educational institutions, but today, even the accepted understandings of enrollment and teachers have changed. While this posed a major data challenge during school closures, in the long run, it may enable EMIS to monitor and record learning that is happening through more diverse and flexible learning paths.

These considerations, along with the priorities stated in Section 2, offer contextualized solutions to EMIS challenges that enable proactive and forward-looking data systems while remaining sensitive to capacity constraints.
Section 4 Way Forward

The pandemic brought global awareness to the limitations of the current conceptions of EMIS, shedding light on the struggles of existing systems to remain effective, inclusive and resilient during education disruptions. At the same time, the COVID-19 pandemic presents a set of unique opportunities to tare the scales, to recalibrate, and to come to a clearer collective understanding about what the roles and responsibilities of EMIS should be.

This paper summarized the EMIS challenges that have been faced by countries before and during the COVID-19 crisis. The paper also reviewed the opportunities that came with the global solidarity to learn from each other and support those in need in order to respond to and recover from the unprecedented learning disruption. Every crisis is a blessing in disguise – as education is being reimagined, so can—and should—EMIS. In this chapter, the key discussion points for the international EMIS seminar are presented to facilitate the dialogue to jointly envision futures of EMIS.

What are the key principles of future EMIS?

The main purposes of future EMIS, powered by enhanced digital connectivity and frontier technologies, are to transform data into actionable information at all levels of education for better learning for all. The new system should also be able to reduce administrative burdens of data collection, analysis, and dissemination through process automation. Such systems shall be guided by the key principles outlined below. UNESCO will compile the participants’ views and suggestions on the key principals of future EMIS during the international EMIS seminar.

1. Open, complete and inclusive data
2. Interoperability and integration
3. Bias-free algorithms
4. Data privacy and legal ownership
5. Affordability and accessibility
6. Scalability and sustainability
7. Focus on local ecosystems and capacity development

How to leverage international cooperation through international communities of practice to support development of future EMIS?

Envisioning and realizing future EMIS will take a concerted effort from a wide range of experts who share the same goal of transforming EMIS for better learning for all. UNESCO proposes to create an international Community of Practice (CoP) comprised of education planners and policy makers, development partners (including civil society organizations), IT experts, statistics and learning analytics experts, and private sector partners. The proposed objectives of the CoP are presented below for further discussion during the international EMIS seminar.

1. Standard-setting for future EMIS
2. Knowledge generation and dissemination
3. Sharing of best practices and mutual learning
4. Facilitating IT development and connectivity
5. Capacity development & supporting the EMIS transformation paths

During Day 3 of the international seminar, the participants will discuss how such CoP could be formulated and facilitated to collaborate towards the shared goal.
REFRENCES


• UNESCO. 2019a. Beijing Consensus on Artificial Intelligence and Education. UNESCO Digital Libraries https://unesdoc.unesco.org/ark:/48223/pf0000368303


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Education is UNESCO’s top priority because it is a basic human right and the foundation for peace and sustainable development. UNESCO is the United Nations’ specialized agency for education, providing global and regional leadership to drive progress, strengthening the resilience and capacity of national systems to serve all learners. UNESCO also leads efforts to respond to contemporary global challenges through transformative learning, with special focus on gender equality and Africa across all actions.

The Global Education 2030 Agenda

UNESCO, as the United Nations’ specialized agency for education, is entrusted to lead and coordinate the Education 2030 Agenda, which is part of a global movement to eradicate poverty through 17 Sustainable Development Goals by 2030. Education, essential to achieve all of these goals, has its own dedicated Goal 4, which aims to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.” The Education 2030 Framework for Action provides guidance for the implementation of this ambitious goal and commitments.