



An assessment of the Education Management Information System in Sierra Leone and potential for enhanced disability inclusiveness

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ABSTRACT

Millions of children live with disabilities worldwide and many of them are at risk of being excluded from education, particularly in low- and middle-income countries (LMICs). For children with disabilities enrolled in schools, learning outcomes and completion rates are often lower compared to that of their peers without disabilities. The effective and equitable access to education for all requires robust education data systems to monitor potential inequalities. For this purpose, Education Management Information Systems (EMIS) have been deployed, with varying degrees of effectiveness. In Sierra Leone, EMIS was established in 2006 but the evidence on its effectiveness and inclusiveness remains limited. This study aimed to examine the strengths and weaknesses of the current EMIS and determine how it can be made more disability inclusive. Guided by the System Approach for Better Education Results (SABER) EMIS framework, the study collected data through a documentary review, interviews and focus group discussions with purposively selected education stakeholders. The study revealed that EMIS in Sierra Leone is at the emerging stage of development and while it is a major government priority, there are several weaknesses that need to be addressed in order to maximise its overall performance. At present, EMIS equates to the annual school census; it presents data on a number of indicators, including disability status, but only in the aggregate format. EMIS does not contain any individual student data making educational planning challenging. The study provides a number of recommendations for system strengthening.

Introduction

An estimated 240 million children live with disabilities worldwide; many of them are at risk of being excluded from education (UNICEF, 2021). In some low- and middle-income countries (LMICs), as many as one in two children with disabilities are not in school (UNESCO Institute for Statistics, 2018). For children enrolled in education, school completion rates and learning outcomes are often lower than for children without disabilities (Kuper et al., 2014; Mizunoya et al., 2018; UNESCO Institute for Statistics, 2018). The consequences of educational exclusion are considerable and long lasting with a devastating impact on health, economic wellbeing, and social participation (Hirpa, 2021; Mont, 2021).

The importance of securing access to education for children with disabilities is reflected in the Sustainable Development Goal for education (SDG 4), which aims to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” (UN

General Assembly, 2015). Article 24 of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) calls for state parties to ensure that “...children with disabilities are not excluded from free and compulsory primary education, or from secondary education, on the basis of disability” (Srivastava et al., 2015; UN Committee on the Rights of Persons with Disabilities (CRPD), 2016). To achieve these ambitious goals, strategies for inclusive education must be integrated in national policies and plans and be effectively implemented at all levels of an education system (Abdul-Hamid, 2017).

Guided by the UNCRPD, this paper uses the biopsychosocial model of disability. This model presents disability as the interaction between a long-term health condition or physical impairment and an unaccommodating environment, in turn limiting activities and restricting participation (Cockburn et al., 2023; ICF, 2001). The long-term impairment or health condition may be physical, sensory, mental or intellectual. This definition of disability emphasises that in considering disability inclusive education, it is essential to consider both a child's

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individual impairment or health condition, and the context in which their education occurs. This is broadly consistent with the Persons with Disabilities Act, 2011 of Sierra Leone, which defines disability as ‘a physical, sensory, mental or other impairment which has a substantial long-term adverse effect on a person’s ability to carry out normal day-to-day activities’ (GOSL, 2011b).

To make inclusion a reality, education systems need adequate and accurate data and effective tools to monitor the equity of access, participation and attainment for children from different backgrounds, especially those with disabilities. In most LMICs however, data available to education stakeholders for decision-making remains limited (UNESCO Institute for Statistics, 2019). Few countries collect data on children’s family background or record their individual functional or developmental difficulties. Where these data are collected, it is often done using inconsistent tools, or stored in formats that cannot be easily used by education stakeholders for planning and budgeting purposes (UNESCO Institute for Statistics, 2018). In the absence of granular data, the capacity of educational stakeholders to fully understand the problem of educational exclusion and how it varies between and within countries continues to be weak, which significantly undermines the effectiveness of national policies, educational planning and budgeting (Banham & Papakosta, 2018). A cornerstone paper published by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in March 2017 called for data revolution in education and stated that “it is clear ... that there are insufficient data for monitoring SDG 4, particularly with regard to equity. Dimensions of equity are not measured in a comparable way across instruments ..., and international agencies. National and international norms and standards are either non-existent or not consistently applied, which can lead to incompatible data and ultimately misinformed policies” (UNESCO, 2017).

Identification and diagnosis of disability is limited in Sierra Leone, particularly among children. Access to health services is extremely limited, and referral pathways, including those from schools, are not well defined. Many medical staff lack training and resources required for accurate diagnosis of disabilities. Additionally, individuals with impairments, including children and their families, are often unlikely to seek medical help due to prevailing negative traditional beliefs and stigma associated with disability (UKAID et al., 2021). The Multiple Indicator Cluster Survey (MICS) conducted in Sierra Leone in 2017 found that as many as 23 % of children aged 5–17 years had a disability in at least one functional domain. The most common functional difficulty was managing emotions with 13 % of children experiencing severe anxiety, and 9 % of children experiencing depression on a daily basis. The findings further showed that many of these children were attending school, but their learning needs were rarely recognized and addressed in a classroom setting. Prevalence of sensory disabilities, such as vision and hearing difficulties were relatively low (0.2 %) but up to 50 % of these children were out of school (Statistics Sierra Leone, 2018).

Childhood disability is a policy priority for the government of Sierra Leone and has taken several measures to increase the enrolment of children with disabilities in schools. In 2011, the government enacted the Disability Act, which recognised the rights and privileges of persons with disabilities, and made discrimination on the ground of disability a criminal offence (GOSL, 2011a). The Amendment Bill introduced in 2020 further re-enforced the government commitment to disability rights and to ensuring inclusive quality education, from pre-primary to senior secondary (NCPD, 2020). In 2021, the government launched the National Policy on Radical Inclusion in Schools, which provided a roadmap for schools to ensure inclusion and positive experiences for all learners regardless of their gender, disability or other individual characteristics. The policy focuses on four sub-objectives: creating inclusive learning environments, targeting support to vulnerable learners, engaging families, and communities, and creating an enabling policy environment (MBSSE, 2021b). The current Education Sector Plan was built on four key principles: universal access, comprehensive safety, radical inclusion and quality teaching and learning. The Plan prioritises

support of children with disabilities at all levels in the education sector (GOSL, 2023).

The implementation of these ambitious policies requires robust data on children with disabilities and their needs. The data should be available in a standardised and easily accessible format in a central database like the national Education Management Information System (EMIS) (GOSL, 2020). Since its established in 2006, very few studies have been undertaken to assess the capacity of EMIS to meet this requirement (Birmingham et al., 2022). The study presented here addressed this apparent knowledge gap and aimed to examine the strengths and weaknesses of the current national EMIS in Sierra Leone and its capacity to support effective decision-making, with a specific focus on disability.

Methods

The study drew on the World Bank System Approach for Better Education Results (SABER) EMIS framework. The framework describes an effective EMIS as one with a fully functioning information cycle that goes beyond annual data collection to serve the needs of a range of education stakeholders, informing them about the effect of education policies and helping them to make decisions and changes, where necessary. Information generated is also fed back into the cycle to improve the teaching and learning process. The framework has been used in several countries to measure the effectiveness of EMIS (Abdul-Hamid, 2014; Costin, 2014).

Study design and setting

The study used a qualitative design, documentary review, focus group discussions (FGDs) and key informant interviews (KIIs) with a broad range of stakeholders. Data were collected at the national level in Freetown, the capital of Sierra Leone and in Bombali and Karene districts in northern and northwestern regions of the country respectively. These districts were selected purposefully, as the authors had been previously involved in the implementation of an inclusive education project in these districts and had good working relationships with education stakeholders at the school and district levels.

Study participants

Respondents for FGDs and KIIs were selected purposefully and included officials of the Ministry of Basic and Senior Secondary Education (MBSSE) at the national and district levels, representatives of international organisations supporting EMIS, education managers, EMIS officers, and school level staff involved in collecting and using education and special needs data. A total of 43 respondents participated in the study, 13 were interviewed individually and 30 took part in various FGDs. Three respondents (two from international organisations and one government official) declined our invitation to participate in the study.

Data collection and tools

Document review and analysis

We searched for published and unpublished literature on EMIS in Sierra Leone, education and data policies and annual school census (ASC) forms, methodological guidelines and reports. Our search was limited to studies and reports which were published before 14 April 2021. Other than our own routine programme reports on inclusive education in the country, our search identified 34 published and unpublished documents. These were individually screened for relevance, which identified 18 documents included in our final documentary review and analysis.

Key informant interviews and focus group discussions

Topic guides used during the KIIs and FGDs were developed based on the scoping literature review, documentary analysis and the questions of

the SABER EMIS framework across four EMIS domains: a) enabling environment, b) system soundness, c) data quality and d) data utilisation (Abdul-Hamid, 2014; Banham & Papakosta, 2018; Bank, 2015). For the purpose of this study, the SABER-EMIS framework guiding questions have been adapted to reflect a disability lens. During the KIIs and FGDs, participants were asked about the current status of EMIS, the sources of data and the processes of data collection, analysis and use; specific challenges and bottlenecks and how stakeholders at different levels dealt with them. Several questions focused specifically on data related to disability and special educational needs.

Data collection took place between September and November 2021. All KIIs and FGDs took place at the places convenient to respondents, usually their workplace.

Data analysis

Data from KIIs and FGDs were audio recorded, transcribed verbatim and analysed thematically using Nvivo 12 software. Literature describes several ways of assessing the performance and effectiveness of EMIS (Irving, 2019; UNESCO, nd) but there is no one agreed method of analysis applicable to all settings. We coded our data alongside reading the documents and interview transcripts and assigned thematic codes, as they arose. The coding was done by one author (SK) and verified by another author (SB). The codes were then merged under themes and subthemes for narrative presentation of findings. We also used the SABER-EMIS framework as the second line of coding to ensure our data corresponded to the framework domains, where it was applicable.

Ethical considerations

Approvals to conduct this study were secured at several levels. First, we received an administrative approval from MBSSE to conduct the study within the education sector, and this enabled us to engage education sector staff at the national, district and school levels. We also secured approval from the Sierra Leone Ethics and Scientific Review Committee, the institution responsible for reviewing and approving research activities in the country. In addition, we consulted and obtained consents from the District Education Offices in Bombali and Karene districts to allow us access to school personnel. The study team provided detailed information about the study and the use of data and obtained written consent from all participants before the KIIs and FGDs. Confidentiality was ensured at all stages. All audio recordings and transcripts were kept on password protected computers and accessible only to the study team.

Findings

The key themes arising from the documentary review and analysis of transcripts were grouped under three broad themes and several sub-themes, where applicable.

EMIS historical development and purpose

EMIS was established in Sierra Leone in 2006 with support from UNESCO to house educational data in a central warehouse where it could be easily accessed and used by the government and its partners to monitor and improve performance of the education sector. The EMIS Unit was set up in the then Ministry of Education to coordinate the first Annual School Census (ASC) conducted in 2007; and since then, the key function of EMIS has been to store and disseminate data collected through the ASC (Mothobi & Gillwald, 2018). EMIS provided a platform for users to access education-related statistics collected through the school census and use it for the purpose of planning and decision-making. Based on the ASC, EMIS provides data on school enrolment trends, which is used by the government and its partners to plan educational provisions, recruit teachers and allocate financial

resources (UNICEF, 2019). The link between EMIS and planning was demonstrated by an MBSSE official below.

"I believe we had scattered data around schools and that was difficult for the sake of planning. So, I think the need was urgent for the establishment of centralized system to collect, analyse and present data for the sake of planning and policy intervention" (Director of EMIS, 16/9/2021).

Study participants also described another online platform, Education Data Hub, launched in 2019 by the Directorate of Science, Technology and Innovation (DSTI) located in the Office of the President of Sierra Leone. The Data Hub uses the ASC data but was designed to connect the ASC data and the national examination results. It serves as a tool to support research, planning, decision making, and to evaluate interventions across schools. Some stakeholders argued that the Education Data Hub was able to process, package and present data in more innovative and user-friendly ways, as it received more political and financial support than the national EMIS.

"And then, the annual school census, the digitized, geo-tagged and all the information is collected from 2018 onwards, and this data has been shared with DSTI and DSTI helps the ministry to make the data publicly available" (Education Specialist, World Bank Sierra Leone, 06/10/2021).

Some participants also pointed to alternative ways of collecting and storing real-time education data, but this was done largely within individual projects supported by development partners and using different data collection platforms. For example, Quality Assurance Officers said that they were required to collect data using tablets and a software called Tangerine, as part of the performance-based financing scheme under a project funded by UK AID. UNICEF collected similar data but used another data collection platform, Edutrac. Both projects collected data on pupil attendance, teacher presence and the use of lesson plans. All data were uploaded into servers operated by these respective projects and used for the purpose of paying performance incentives to participating schools.

In addition, MBSSE has situation rooms in all districts across the country, which frequently receive real-time data on student enrolment, attendance, new entrants and drop-outs. This vital information is however not uploaded into EMIS to update data collected by the ASC. While data collection in the education sector has seen significant improvements, available data is still fragmented and underused due to lack of connectivity between the different education databases (GOSL, 2023). Other critical education sector data is held in the Teacher Management Information System, the West African Examination Council databases, and other assessment body databases, but again does not feed into the EMIS. Without this data feeding into the EMIS, and making it a one-stop-data hub, information remains inaccessible for purposes of policy formulation, planning, resource allocation and for monitoring key performance indicators in the education sector (GOSL, 2020). With relation to children with disabilities in particular, the appropriate linkages would strengthen understanding of levels of teacher training in disability inclusive education, and whether teachers with the relevant training are appropriately distributed across the country. Linkages with individual-level attendance and assessment data would enable tracking and monitoring of educational retention and outcomes for groups of vulnerable or marginalised learners, including those with disabilities.

EMIS regulating policies and budgets

Several national policy documents recognised EMIS as a critical strategic management and monitoring tool in the education sector. (MBSSE, 2021b). At the time of the study however, there was no specific policy on the operation of EMIS and study participants explained that the process to formulate a national EMIS policy has been initiated but was yet to be completed. In the absence of a national policy, the EMIS Norms and Standards Assessment Framework (ENSAF), developed by the Association for the Development of Education in Africa (ADEA) was

used as a guiding policy.

When asked about the EMIS budget, one of the study participants explained that there was some money allocated to EMIS within the Directorate of Planning and Policy (DPP) budget and there was some financial support from development partners. However, no details were provided on the resources available for the operation of EMIS. It emerged from most respondents that EMIS was dependent financially on multilateral agencies, such as the World Bank, the European Commission (EC) and UNICEF.

It was also pointed out that some key personnel supporting EMIS were contracted on a short-term basis and paid by either the EC or UNICEF; and although the EC had recently extended the current employment contracts for EMIS staff by six months, donor expectations were that the staff would be transferred to the government payroll. At the time of the study there was no evidence that this was happening.

"...those staff that you see, the EMIS staff, we were paying them on an agreement with the ministry that those staff would be employed after a given period. So, in fact we extended their contract by six months, and it was on the request of the ministry that they needed that period to be able to regularize their status." (Education Specialist, EU Delegation, 30/9/2021).

Annual school census

Purpose and processes

The first ASC was conducted in Sierra Leone in 2007. Data collection had been carried out using paper-based forms until 2018, when a digital data collection system was introduced. The two key stakeholders in the ASC named by study participants were Statistics Sierra Leone (SSL), which helped to plan and validate the data, and the National Civil Registration Authority (NCRA), the government arm responsible for vital statistics and national identity. Other stakeholders included local councils, development partners and NGOs. The school census was funded by the government, with the support from the World Bank, EC, UNESCO, UNICEF and sometimes other development partners.

Study participants explained that the school census was conducted once a year, with the purpose of providing data on schools, student enrolment and the status of teachers. The key indicators included the number of schools and children enrolled, information on teachers (numbers, qualifications/experience, status of employment), state of the physical school infrastructure, and the availability of water, sanitation and hygiene facilities.

Respondents further noted that the school census process was highly structured and followed several pre-defined steps. Planning was usually initiated by the DPP who, in consultation with the Minister and Chief Education Officer, brought together other senior officials and introduced the census, proposed timelines and outlined roles and responsibilities. Further meetings were usually conducted with development partners (UNESCO, World Bank, EC and UNICEF) and other stakeholders (SSL, NCRA, the Teaching Service Commission and Sierra Leone Teachers Union). Other players, especially NGOs, working in the education sector were consulted at this stage to express their views on what they wanted to see in the census form.

"We work with Statistics Sierra Leone, the National Civil Registration Authority and the Teaching Service Commission. ...we want to send out questionnaires to all our partners, including Sightsavers [for review]. People do send in proposals, and we validate the questionnaire before we get the final one to send to the field". (EMIS Statistician and Data Analyst, 21/9/2021).

As consultations and meetings progressed, planning sessions became more technical and committees were formed to focus on the methodology, data collection tools, updating the school master list, human resource requirements and budget. One of the key tasks at this stage was to review the census form to add new data areas based on emerging issues in the education sector. Once the proposed changes were agreed, the census form was finalised, approved, inputted into mobile data

collection platform SurveyCTO and uploaded into tablets, ready for data collectors. Training was a critical component of the planning phase, which started with training of trainers, who in turn trained district enumerators, supervisors and headteachers of secondary schools.

It was further revealed that the Ministry had two documents to guide data collection and to ensure methodological soundness during the school census. The DPP published the Data Dictionary of Education: Concepts and Terms, which served as a guide and reference for compiling education data (MBSSE, 2021a). The second document was the step-by-step guideline on how to complete the ASC form:

"[guidelines] accompany all the [census] forms at every level to help heads of school acquire more understanding of the form and how to complete it." (Director of EMIS, 16/9/2021).

Overall, study participants pointed out that the ASC was a significant achievement of the education system, as it generated data on every school in the country. It was also noted that collecting data from all schools was a major effort, considering that many schools were in remote and hard-to-reach areas.

"It is not too easy but when you are required to go there [schools in remote locations] to collect data as part of your work, you just have to face the strain and go there, because you are paid for that. The fact is, you cannot sit anywhere and do that work, you have to go there. But the last time we did it when there were no tablets, I was the one that distributed most of the census forms to these remote locations. In fact, I still have one that I have not delivered, but will do so on Monday (FGD with teachers, SLMWBO Primary School, 5/10/2021).

Data collection in schools

Study participants explained that the ASC used two data collection approaches. In the first approach, census forms were distributed to the heads of nurseries and primary schools two weeks before the census, with detailed instructions on how to complete the forms. School Quality Assurance Officers (SQAOs) who usually served as enumerators visited each school to verify the data collected and to ensure that all sections of the form were completed correctly. To ensure accuracy of the enrolment figures, SQAOs were required to conduct a headcount of children enrolled in the school. After this verification process, data from the forms were transferred into the tablet in the presence of the headteacher.

This process of data collection was described by study participants, as ideal. In practice, however, it did not always happen as designed. For example, some study respondents said that SQAOs performed verification and headcounts in schools which were easily accessible, while data from schools in hard-to-reach locations remained unverified.

So, most of the enumerators that come to work, when they deploy them to different areas like Tambhaka, which is very terrible for traveling, most of them do not go there. Some of the enumerators will just go to the school, take the GPS coordinate and then leave the questionnaire, because it is mandatory that when you go to the school, collect the information in your tablet, you also collect the paper questionnaire. Most of them do not do that so that's a big challenge, selection of enumerators (EMIS ICT Officer, Karene district, 12/10/2021).

In many difficult to reach areas, enumerators arranged with teachers in their clusters to bring their completed census forms to a centrally located school, where data were entered into the tablets. In some locations, enumerators arranged with teachers to send their completed forms to the District Education Office where data were entered electronically by EMIS officers. Study stakeholders argued that SQAOs working in remote areas adopted these approaches to cut down on travel time and to complete the census within the agreed timeframe.

The second approach to the ASC data collection was used in secondary schools. In this approach, heads of schools completed ASC forms and entered information directly into the tablets provided for every secondary school in the country.

Data on children with disabilities

School census form had provisions in the special needs section, to

capture disability data, including the number of learners with disabilities disaggregated by sex, grade and type of disability. It was further explained that in 2017 and 2018, the census form solicited information on inclusive infrastructure, including ramps and railings available in schools, and whether WASH facilities were accessible. Data were also collected on the availability of accessible educational materials and assistive devices such as braille books and audio and visual aids. In 2019 however, the disability section of the census form was amended to collect only two disability-related indicators: the number of children with disabilities enrolled and the accessibility of school toilets.

It was further explained that data on disability were collected in schools using two approaches. In primary schools, data on disability were entered by the headteacher, with minimal inputs from class teachers, and based on their personal experience and understanding of disability. In secondary schools, other teachers supported the principal in collecting disability data. Class teachers were brought together in a meeting where they reported disability data for their classes. Every presentation was discussed before the data were entered electronically. It was thought that due to the involvement of other teachers, disability data collected in secondary schools were more accurate compared to those from primary schools. At all levels, however, only data on known and visible impairments in pre-defined categories were entered in the census form.

In schools receiving support and disability training from development partners, teachers known as Inclusion Champions kept records of children with disabilities enrolled, and these records were updated periodically. In such schools, these data were used in the ASC.

Every year, with or without any intervention, we prepare information on all the children with disabilities in the school for our own records. We often record the name of the child, category of disability, family background and location of the child, in terms of how far or close to the school. We keep this information, which we share [with] the ministry and NGOs whenever they ask for it (FGD with teachers, Wuror Memorial JSS, Rokulan, 7/10/2021).

In 2022, the ASC collected disability data on five types of impairments: visual, hearing, speech, physical and learning. The 2022 ASC collected data on 12,466 schools, and 3,343,470 learners, 51 % of whom were girls. The number of learners with disabilities was recorded at 44,792 or 1.3 % of the school population. About 4 % of these children were enrolled in pre-primary school, 62 % in primary school, 24 % in junior secondary schools and 10 % in senior secondary schools. Among all 44,792 learners with disabilities, 27 % had visual impairment, followed by hearing (21 %), learning (20 %), speech (18 %) and physical (14 %) (MBSSE, 2023).

The ASC does not include information on the specific accommodations, assistive devices, or other learning support required by children with disabilities, even in aggregate format. This means it is not clear from the ASC data what additional resources, training or support would be required by specific schools, or across the educational sector as a whole.

Data quality and verification

The process of ASC data collection was regarded by respondents as sound, as it was designed by multidisciplinary teams, which involved education planners, statisticians, data analysts, ICT personnel and specialists in the fields of education and data management. Despite this sound planning, the study observed that enumerators and supervisors were often overwhelmed and experienced multiple challenges, which affected the quality of data collected. For instance, despite the support and guidelines provided, heads of schools, especially those at the primary levels, found it difficult to complete the forms without assistance. SQAOs interviewed pointed out that when they visited schools to verify data, they found out that the forms were incomplete and they had to fill them in together with the headteachers, which in turn affected their own targets and timelines.

Then some heads of schools, when we get there for information,

some find it difficult, because they were not properly trained on the use of the forms. So, most times when you get there, you have to sit with them and do everything. Some when they receive the forms, they just keep them because they have no idea how to fill the forms, they were not trained (SQAQ, Karene, 12/10/2021).

It was further noted that education planners introduced several quality-assurance checks in the data collection process. First, every school had a unique EMIS code, which was linked to the school's Global Positioning System (GPS) coordinates; and the software was designed to open only when the GPS location was captured on the tablet to ensure that SQAOs were physically present in the school. Second, the numbers reported by the headteachers were expected to be verified by headcounts. Also, during the data collection, IT officers working in the central warehouse monitored all census forms uploaded into the system, watching for inconsistencies and incomplete forms. For every anomaly identified, the concerned enumerator and supervisor were contacted immediately to address the issue, even if it meant going back to the school.

This study however found that the quality assurance checks were sometimes bypassed, particularly for schools in remote locations with difficult terrain or other circumstances which prevented enumerators from accessing the schools. In such areas, enumerators were not able to verify the quality of data entered into the system. As a result, according to some respondents, school enrolment data were inflated, as higher numbers of students attracted higher subsidies, school feeding support, educational supplies and financial incentives paid through performance-based schemes by development partners.

"We want to prevent excesses going to areas as much as possible, that is what we want, but the principals are sometimes not honest when it comes to subsidy issues. They over-inflate the number of children, so that has been a challenge, but we were fighting it. Because now the minister has included Anti-Corruption Commission in the issue for principals who inflate number of pupils just to extort government money" (Director, MBSSE Curriculum and Research Dept., 16/9/2021).

"In some instances, some school authorities inflate enrolment figures to get more money in subsidies. This is simply because, enrolment is linked to the school subsidy and other benefits that the school receives from the government or other partners" (FGD with Teachers, Wuror Memorial JSS, 7/10/2021).

Study participants pointed out that the quality of data entered was also affected by the significant workload of district enumerators during the ASC. They covered a very large number of schools scattered across large geographical areas, which affected the time they could dedicate to the process of verification and quality control.

"I have 100 schools under my control that I am to collect data from. Now having 100 schools under my control within very limited time, I think there is a problem there, because the schools are too many and the time given there is inadequate. So, most of the time, you find out that we just have to go by the information given by the heads of schools, instead of going out there to verify the information and capture the right one". (SQAQ, Karene, 12/10/2021).

Poor internet connection also contributed to the challenges faced by enumerators, who required strong connection and speed to upload census forms; this was not possible in most rural communities. As a result, they had to travel to other areas to upload data, which slowed down the data collection process and increased their travel costs.

Data processing

Study participants explained that data collected from schools were uploaded directly into the EMIS server at the district level, from where it was transferred to the central data warehouse. It was then exported into Microsoft Excel for data analysis and reporting.

The study confirmed the availability of the servers in Freetown, Bombali and Karene districts (as well as other districts in the country). However, at the time of the study, these servers were not linked up via any network. The lack of connectivity between the servers was noted as

a major weakness of the EMIS system. Participants explained that plans to connect the servers were underway but until then, census data across multiple districts were available in the central warehouse only.

EMIS ICT Officers informed us that although data were expected to be stored in the cloud, the space acquired by the ministry was limited, which posed challenges in uploading and storing data during the school census. As a result, data were often stored on laptops or tablets, making it vulnerable to corruption and loss. This happened during the 2020 ASC, when data losses were reported by ministry officials (Bodo, 2028). The question of maintenance of district servers was also raised, as there was no system in place for routine maintenance.

“So, at times the subscription that EMIS or ministry pays will not be enough. Like I am saying, we have about 11,000 schools in the country. So, if the space that EMIS buys is less than [what is needed], so whenever an enumerator wants to send information, it will not sync. It is a great challenge (EMIS ICT Officer, Karene district, 12/10/2021).

Participants in one of the reflection workshops spoke about the implications of decentralisation of education for EMIS. Respondents explained that while the delivery and management of basic and secondary education had been devolved to district councils, EMIS remained heavily centralised. This means that data collected at the school level had to be collated in a single designated data warehouse, which was time consuming and inefficient. Participants further noted that decentralising EMIS would involve transferring some functions around data management to the districts and possibly to schools. This could bring many benefits, as district-level stakeholders were the key decision-makers in education and needed to be in full control of their data. Some participants, however, cautioned that decentralised processes could lead to data fragmentation, if the data were not coordinated and shared at the central level.

Dissemination and utilisation of data

Study participants further narrated how at the final stage of the ASC a formal ASC report is launched to present summary statistics across schools and districts. The report is published at the MBSSE website, where it can be accessed by the public. Few hard copies are also made available to key stakeholders in the education sector.

It was further explained that the bulk of data generated in schools during the ASC was stored on servers at the district level, where the public could also access it by making a request to either the MBSSE or the district authorities. Education data could also be accessed by contacting EMIS situations rooms located in all districts. Discussions with EMIS ICT Officers at the district level indicated that requests for education data came mostly from NGOs and consultants operating in the sector. Some study participants said that although access to the internet in Sierra Leone was improving, most people could not access the report online due to high costs of the internet and limited ICT skills.

The timeliness of data collected and stored in EMIS was also questioned by some study participants. It was explained that the publication of data collected through the ASC often took four to five months, by that time, some data on enrolment were already outdated. In addition, changes such as new admissions and drop-outs occurring in schools during the school year could not be entered in real time and could not be used for the purpose of planning and budgeting.

Disability data in the ASC report appeared to be brief, no more than one page, which included tabular presentation of data on the enrolment of children with disabilities by sex, class and types of impairment, and some basic data on accessibility of school WASH facilities.

Discussion

This study set out to assess EMIS in Sierra Leone and to establish the extent to which disability data are included in the platform. The study revealed that overall, EMIS in Sierra Leone is at the emerging stage of development and while it is a major government priority, there are several weaknesses within the system that need to be addressed in order

to maximise its overall performance and effectiveness. This study identified strengths and weaknesses across all four domains of the SABER-EMIS framework: enabling environment, system soundness, data quality and data utilisation.

There is a strong policy environment supporting the development of EMIS in Sierra Leone; the system has been in place for over 15 years and is an important national platform for collecting and presenting education data from the entire country. EMIS collects data from all schools at pre-primary, primary, junior secondary and senior secondary levels and is updated annually through the annual school census. At present, however, EMIS effectively equates to the ASC; it presents data on the indicators included in the census form and only in the aggregate format. EMIS does not contain any individual student data. The system allows for monitoring trends in school enrolment over time and across the country but does not reflect any real-time changes, which may occur in schools throughout the academic year.

While an effective platform for collecting, storing and disseminating education data in the aggregate format is undoubtedly needed, it is not sufficient to support decision-making and planning processes, particularly at the school level. Such platform cannot replace the need for individual records on children available in schools. The same argument has been made recently in the Global Partnership for Education (GPE) Scoping review, which identified transitioning EMIS from school counts to individual learner records, as the key global priority for EMIS reforms (Arnott et al., 2023).

Individual data are particularly critical for inclusive education, where children's academic performance, attendance and transition should be disaggregated by potential characteristics of disadvantage, such as disability, gender or family background, to assess equity of educational attainment. In the absence of individual records, such disaggregated data will be difficult to obtain, analyse and act on. More importantly, children's individual needs, including special educational needs, are best addressed at the school and classroom levels (Bah & Maiga 2019; GPE, 2019). The data are most valuable to classroom teachers, who need it to address their teaching and assessment practices and maximise opportunities for student individual support (Abdul-Hamid, 2014). Our study suggests that in secondary schools, data on the impairment status of children collected during the school census comes from classroom teachers. While, it is possible, that teachers do address their teaching approaches based on their knowledge, monitoring progress and performance of children with disabilities across the school without systematic individual records kept at the school level, will be very challenging, if not impossible.

Recent EMIS guiding documents from UNESCO and GPE argued that because of the latest advances in open-source software platforms, such as UNESCO Open or DHIS 2 Education, it became more feasible and possibly cost-effective to compile and store individual student records than it was in the past (UNESCO, 2021; van Wyk & Crouch, 2020). It is therefore critical that both governments and development partners consider the development of such systems in LMICs, including in Sierra Leone. There are many benefits of individual records for inclusive education, as schools will have more granular understanding of children's individual needs, and how disabilities interact with other characteristics of disadvantage (e.g. gender, poverty, family background).

Our study also provided some useful insights into the annual school census. It showed that the ASC data collection in Sierra Leone follows a rigorous process and involves many stakeholders. ASC enumerators and supervisors are thoroughly trained and there are rigorous quality assurance checks and data verification mechanisms built into the census. However, we also found that these checks and verification mechanisms are not always implemented, as designed, particularly in remote rural locations. There are deviations from the headcount verification processes and data completion checks, usually due to tight schedules and heavy workload of census enumerators and high costs of travel to hard-to-reach locations. Furthermore, whilst the ASC form is updated annually in response to emerging issues in the education sector and there are

guidelines on conducting the ASC and completing the census forms, these are not circulated widely within districts and are not always available in rural areas. Importantly, individual school records completed and updated in real time have potential to address many of these challenges, improve quality of ASC data and potentially save costs of data verification.

The ASC does collect data on children's disability status, focussing on five categories of impairments, namely, visual, hearing, communication, physical and learning. The 2022 ASC report suggests that 1.3 % of learners in mainstream schools have at least one impairment (MBSSE, 2023). The estimate is considerably lower than the estimate in the 2017 MICS survey (23 % in the age group 5–17 years). The MICS survey was household-based and included both in school and out of school children and the assessment was based on functional difficulties reported by the main carer, which included behavioural and psychosocial (anxiety, depression) domains, where the highest prevalence of functional difficulty was found (Leone, 2018). It remained unclear in our study how the impairments reported in the ASC were identified; and given that at present, schools do not have individual student records, it appears that the judgement on child's disability status was made by either the headmaster or class teacher based on their observation.

Data collected by ASC focuses on disabilities of children, rather than the functional difficulties they face. This approach stands the risk of missing out on children with minor impairments, even though these minor impairments can have significant impact on the child's ability to learn. In addition, data on disability currently held on EMIS is in disaggregated form, which is difficult to use for effective planning and for monitoring progression of children with disabilities. Creating individual records of learners with disability will make EMIS more effective in keeping accurate data on disability and in tracking progression of children over time. Specific data that can be kept on children with disabilities include demographic (age, sex, location), education (attendance, assessments, progression), the school environment and services available (GOSL, 2023; Mont, 2024). Additionally, information on the specific accommodations, adaptations and support needs of individual children would be valuable in ensuring the allocation of appropriate resources and training, and in supporting educators to consistently meet children's inclusion needs.

A complete and efficient EMIS provides systematic, quality and timely data to support evidence-based decision. It must be able to track student records over time from pre-primary to senior secondary school and where possible into higher education. Most countries, including Sierra Leone, struggle to meet this standard due to inadequate budgetary allocation (thus depending on external actors), lack of operating policies, limited staff capacity and low government commitment (Abdul-Hamid, 2014). In addition, several countries still maintain inadequate disability data on EMIS. Despite these challenges, some LMICs like Tanzania and Timor-Leste provide good examples of functional EMISs, where the word 'disability' is not mentioned in their data collection questions as they focus on functional challenges learners with disabilities face. Timor-Leste and Fiji for example use the Washington Group Questions in assessments and in their analysis, they keep children with minor functional difficulties separate from those with more significant difficulties. This approach provides well-defined data for evidence-based planning, intervention and evaluating educational performance of children (GOSL, 2023; Mont, 2014). Taking inclusion further, the New Zealand EMIS monitors soft indicators, including whether learners with disabilities feel cared for, safe and secure in school. Including inclusive indicators into EMIS is an emerging best practice and UNICEF recently produced guidelines on including disability-related questions in school census forms and further defined minimum requirements for inclusion (UNICEF, 2016, 2020).

In recent years, there has been an extensive discourse on the best ways to establish and record disability status of children in schools (Beth Sprunt, 2019; Cialesi R et al., 2016; Sprunt et al., 2019). Many experts believe that in the context of limited access to healthcare service and the

lack of systematic clinical assessments of children, records based on the observed functional difficulties are more accurate and useful than the records of the perceived impairment, for a number of reasons (Cappa et al., 2015; Simelane, 2008). First, there are no standardised definitions and methods that could help teachers to establish the presence of an impairment, thus reported data is inconsistent and incomparable across schools. Second, systems which require schools to record children only under one impairment category (which many school censuses do), stand the risk missing and adequately documenting all child's needs, as many impairments can cause difficulties in functioning in more than one domain. EMIS systems which enable records of difficulties in multiple categories have more sophisticated data for planning of educational services, particularly at the school level. In the Sierra Leone ASC, there is nothing which fundamentally prevents a school including a child in multiple disability categories – and in the absence of individual learner records, there would be no way to establish whether that was done or not. However, the processes of data aggregation for reporting assume that no child is present in multiple categories and derive a total number of children with disabilities by adding across all of the categories. It is not clear why this is the case. Given the substantial resource requirements of large-scale data collection efforts like the annual school census, it is likely that the limited number of domains included in most countries is driven by efforts to manage the cost and time attached to disability data collection. While this approach saves cost, data produced is often inadequate for measuring disability in schools and for planning and policy formulation (Loeb et al., 2008).

However, it is also important to highlight that, whether child assessment is based on impairment or functional difficulty, there are issues of capacities required to both consistently assess and accurately record disability data. Teachers and headteachers require adequate training and guidelines and the systems require investments in technology and infrastructure. Our study highlighted several infrastructure challenges experienced by EMIS in Sierra Leone. Poor Internet connection and the inability to regularly upload the data collected during the ASC increased the workload and costs of census enumerators and undermined the data verification processes. At the time of the study, servers in districts providing storage for the ASC data were not linked up in one network, making data analysis across districts more difficult. Space on the cloud acquired by MBSSE to store census data was limited. As a result, data were often stored on laptops or tablets making it vulnerable to data corruption and loss. There were uncertainties about funding of system maintenance and ICT personnel responsible for data analysis.

At the same time our study found that some development partners established their own data systems to monitor their project activities or performance-based financing schemes. Whilst it is understandable that development projects operating within a limited period of time and under tough targets, may want to establish a data system, which they can fully control, such parallel systems can result in duplication of efforts and data fragmentation. They are also likely to divert limited human resources and expertise from already stretched and under resourced government systems. It would be more effective and sustainable if development projects invested in one government-run system, which would help to build its infrastructure and capacity over time.

There are not many examples of good EMISs in LMICs, which effectively and consistently assess and record disability data in schools and could be used as a blueprint for other countries. A recent review of EMISs in the Pacific Islands published by Sprunt and colleagues in 2016 identified three types of systems of recording disability data in the countries included in the study: i) granular systems, which record disability status on individual children's electronic files integrated in EMIS; ii) census-based systems, which record disability data alongside other variables reported in the aggregate format during the ASC; and iii) systems with separate databases, which record disabilities, and which may or may not be integrated in EMIS. The review acknowledged that EMIS realities are complex and shaped by geographic, economic and

cultural determinants of their settings. It however called for maximising opportunities given by technology and a global appetite for better data in education and to develop robust approaches to disability disaggregation and production of data, which is meaningful and useful for education stakeholders (Sprunt et al., 2016). Findings from our study are fully congruent to this conclusion.

Our study has several policy implications and recommendations for each of the dimensions of the SABER-EMIS framework.

To improve the enabling environment:

- develop a normative base, which regulates the operation and maintenance of EMIS at different administrative levels.
- ensure a sufficient dedicated budget to finance all aspects of EMIS and its support.
- ensure qualified human resources are deployed on sustainable long-term contracts.
- make guidelines on how to complete ASC forms simple and widely available across the country.
- develop consistent guidelines and training on how to collect disability data.

To improve system soundness:

- explore ways of how to collect, maintain and regularly update individual-level data, including data on disability and other children's characteristics
- consider the number of disability data indicators required regularly or periodically to support the planning of inclusive education at different levels
- improve internet connectivity at schools and at different administrative levels.
- link up and improve the interoperability of district-level servers
- increase the capacity for education data storage.
- ensure regular maintenance of EMIS at different levels.
- align different systems and processes for collecting educational data and streamline all data collection through EMIS.

To improve data quality:

- ensure ASC data verification in difficult-to-reach locations and ensure data enumerators have sufficient time and resources to visit remote schools.
- ensure quality-control measures are in place and strictly followed.
- ensure teachers who are in close contact with children are trained and involved in collecting disability data in all schools.
- develop mechanisms for a regular update of education data throughout the school year.

To improve data utilisation:

- ensure that the ASC report is available to decision makers and education stakeholders in an appropriate, accessible and user-friendly format at all levels.
- raise stakeholders' awareness on where and how to find disability data.
- build capacity of education stakeholders to understand and regularly use education data

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CRediT authorship contribution statement

Steven Kaïndaneh: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources,

Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Julia de Kadt:** Writing – review & editing, Validation, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Stevens Bechange:** Writing – review & editing, Validation, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Emma Jolley:** Writing – review & editing, Validation, Conceptualization. **Nancy Smart:** Writing – original draft, Supervision, Funding acquisition. **Elena Schmidt:** Writing – review & editing, Resources, Methodology, Funding acquisition, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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