



# Five principles for global learning metrics

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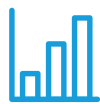
## Executive Summary

Despite the commitment of educators and policymakers worldwide, progress towards Sustainable Development Goal 4 (SDG 4), *Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*, has failed to keep pace with targets. Over 600 million primary and lower secondary aged children lack proficiency in mathematics and reading. Among those students, around a third do not attend school while the remaining two-thirds are not making sufficient learning gains in the classroom.

The UNESCO Institute for Statistics (UIS), as custodian of SDG 4, is unequivocal on the need for 'more and better data' on education, stating that data can serve as a wake-up call for action. The World Bank has led the calls for the use of global learning metrics, which are intended as an international benchmark for evaluating progress towards SDG 4.

This paper examines existing approaches to global learning metrics, arguing that their conception to date has been stifled by the limitations of traditional assessment models. We summarise the main arguments in favour of global learning metrics, such as the visibility they give to educational inequalities. We also review some of the key concerns of their detractors, acknowledging that global learning metrics have the potential to give rise to tensions between formative and summative aims of assessment, and between global standards and local objectives.

This analysis informs five principles upon which global learning metrics must be based in order to achieve their intended aims:



**Data as a by-product  
of learning**



**Vertical alignment**



**Context-driven  
data**



**Low stakes**



**As much localisation  
as possible, as much  
standardisation as necessary**

We look to the affordances of digital technology - and adaptive learning technologies in particular - as a means of realising these principles. Whizz Education's use of its Maths Age™ metric serves as a case study of how global learning metrics can be brought into harmony with the multi-faceted aims of assessment.

## The call for global learning metrics

Progress towards Sustainable Development Goal 4 (SDG 4) has failed to keep pace with targets, with over 600 million primary and lower secondary aged children lacking proficiency in mathematics and reading.<sup>1</sup> Around a third of those students do not attend school, while the remaining two-thirds are not making sufficient learning gains in the classroom.

### A wake-up call for action

The UNESCO Institute for Statistics (UIS), as custodian of SDG 4, is unequivocal on the need for 'more and better data' on education, arguing that "such alarming statistics demonstrate that data can serve as a wake-up call for action."<sup>2</sup> In issuing its collective call for more funding towards SDG4, the UIS points to a compelling investment thesis, claiming that producing all 43 SDG 4 indicators (global and thematic) would cost an average of \$1.4 million per year per country, compared to a return of \$143 million that would arise from the resulting efficiencies in running an education system (not to mention the future dividends delivered by a more skilled workforce). "To put it simply," says UIS director Silvia Montoya, "education systems can only function effectively if their strategies, approaches and funding are built on a solid foundation of data."<sup>3</sup>

The 2019 SDG 4 Data Digest,<sup>4</sup> produced by the UIS, provides an overview of existing efforts to monitor SDG 4 globally. The Digest emphasises "the importance of facilitating the greater participation of countries in the monitoring process at the global, regional and national levels."

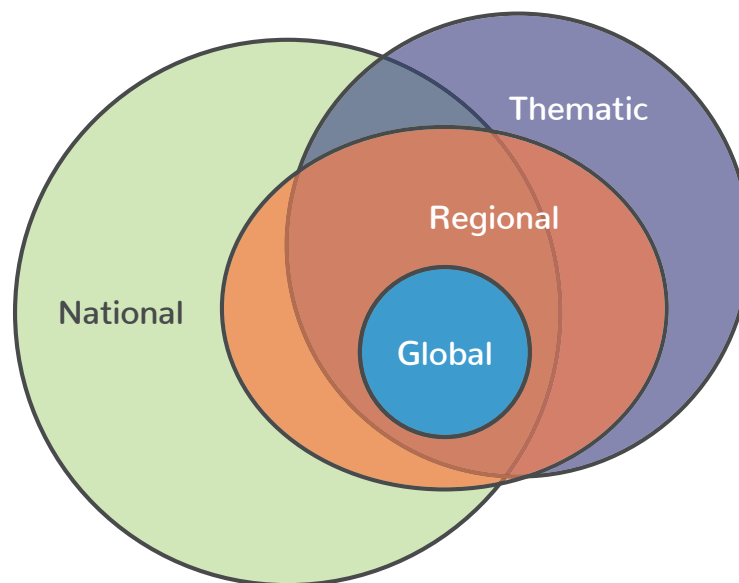


Figure 1

Four levels of assessment (adapted from the 2019 SDG 4 Data Digest)

This framework recognises that educators operate in a multi-assessment world. The imperative for SDG 4 is to quality assure the way in which learning data is collected and reported, which allows for meaningful comparisons across national contexts. As Montoya argues alongside RTI International's Luis Crouch, in the absence of such comparisons, education inequality would forever remain a blind spot.<sup>5</sup>

International comparisons, though, must be cognisant of the localised nature of education systems. The UIS supports "the comparability of existing (and future national) assessments rather than on backing, adopting, "imposing" or even endorsing specific global assessments." The Inter-Agency and Expert Group on Sustainable Development Goal Indicators backs this approach, reporting that "Global monitoring should be based, to the greatest possible extent, on comparable and standardised national data, obtained through well-established reporting mechanisms from countries to the international statistical system."<sup>6</sup>

### Motivating action and accountability

The World Bank has led the calls for global learning metrics, recognising that "education systems need a broad range of high-quality data to monitor and promote student progress and to understand the links between inputs, policies, practices, and learning."<sup>7</sup> Taking note of the trend towards increased participation in international comparison studies, the World Bank posits that a global learning metric would "motivate action and generate accountability for learning."<sup>8</sup> There is an emphasis on "showing what is possible" and giving countries tangible outcomes to aspire to. By exposing learning gaps among disadvantaged groups, a global learning metric could "create pressure for social mobility within countries." A global learning metric, in the World Bank's view, must complement rather than seek to uproot national assessment systems.

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Education systems can only function effectively if their strategies, approaches and funding are built on a solid foundation of data

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Silvia Montoya, UIS

The report acknowledges the efforts of global initiatives such as the Global Alliance to Monitor Learning, the Assessment for Learning Initiative and the International Commission on Financing Global Education Opportunity to develop methods for comparing national measures of learning from one country to the next. The Global Education Policy Dashboard, developed by the World Bank with support from the Bill and Melinda Gates Foundation and the UK's Department for International Development, adds to this effort by highlighting gaps between education research and practice.<sup>9</sup> Core to their approach is collecting learning data "at all levels of the system" and "on a regular basis" within a "system-wide framework".

### A sense of what is possible

Within the research community, Stanford Economist Eric Hanushek lends a prominent voice in support of global learning metrics. Hanushek argues that economic growth is the most important indicator of the performance of an education system.<sup>10</sup> He notes that three-quarters of the variation in economic growth rates across countries is accounted for by the 'knowledge capital' afforded by quality education in mathematics and science.<sup>11</sup> Comparison tests like PISA, according to Hanushek, promote a sense of what is achievable within a given context, though he concedes that such instruments are less useful for prescribing the means of ensuring such outcomes. Like the UIS and the World Bank, Hanushek believes national and international assessments must work in close concert, and that the performance of education systems can be benchmarked against a common set of knowledge and skills (particularly in the STEM subjects), even while allowing for variation between different national curricula.

Evidently, there is a growing appetite among education stakeholders to deploy some form of global learning metrics as a means of measuring the performance of education systems around the world. The tacit assumption is that such metrics are indicative of economic growth within those countries, and that investment in data will reap rewards in terms of quality learning outcomes and long-term productivity. There is some difference of perspective in the methodology behind cross-national comparisons, and the extent to which global standardised assessments should be adopted as a tool for evaluation. A cost-benefit analysis from 2018 presented the three most likely approach to global learning metrics in reading and mathematics, two of which would make no use of national assessments and the third of which would include both national assessments and a global reporting scale.<sup>12</sup>

The enterprise of global learning metrics is not without its critics. Any embrace of data-intensive approaches to education must be mindful of their limitations and unintended consequences. The next section gathers the most essential critiques of global learning metrics.

## Common objections to global learning metrics

One set of concerns around global learning metrics relates to their perceived narrowness of scope. As one commentator puts it, “the only learning that counts is school-mediated, book-based academic knowledge.”<sup>13</sup> With respect to participation, particular concern has been reserved for the exclusion of out-of-school children who, despite representing the most marginalised youth, are not reflected in this data.

There are also suggestions that international comparative assessments place disproportionate emphasis on the technical components of literacy and numeracy, at the expense of other, more holistic educational outcomes.<sup>14</sup> As early as the 1990 World Conference on Education for All, it was acknowledged that “the development of the creative potential of the individual, of imagination, of spiritual and aesthetic values, of community spirit, are justifiable in their own right, and not easily measurable in the short term...”<sup>15</sup> Efforts to measure SDG 4 have been characterised as a zero-sum game, with the knowledge and skills needed for sustainable development and global citizenship often left on the side lines.<sup>16</sup> As the highest profile assessment, PISA draws special criticism for its bias towards economic development.<sup>17</sup> The link between academic outputs and economic growth, according to this critique, betrays a narrow envisioning of what education is for.<sup>18</sup>



**There is a tension between the standardised imprint of global learning metrics and the diversity of curricula and learning experiences that are implied by the varied characters of nations.**



### Global standards in local context

Another concern relates to the lack of context in conversations around global learning metrics. David Edwards, of the global federation of teacher unions Education International, argues that test scores possess an innate cultural bias because they do not account for the conditions under which these assessments take place: “many times, the child maybe didn’t eat. Maybe you’re doing it at an age where most kids were pushed out of school or where there wasn’t a secondary education available to them.”<sup>19</sup>

Aside from issues of scope, there is a perception that global learning metrics signify a push towards control and compliance, rather than autonomy and genuine improvement in learning and teaching. Karen Mundy of the Global Partnership for Education suggests that single-source assessments like PISA undermine self-sufficiency at the national level.<sup>20</sup> Whatever notions we have of efficacy, they must be situated within each country's sociocultural context. There is a tension between the standardised imprint of global learning metrics and the diversity of curricula and learning experiences that are implied by the varied characters of nations.

### Formative and summative assessment: conflicting aims?

Standardised assessment, especially when it is used for the purposes of cross-national comparisons, can become heavily politicised as policymakers seek to attribute gains to their own inspired interventions. Equally, it is not uncommon for countries who score poorly in comparison studies to be chastised for their educational practices. Even the World Bank, a leading proponent of global learning metrics, has cautioned that "when a single metric becomes the sole basis for big policy triggers, the corresponding stakes become dangerously high."<sup>21</sup> The result, quite often, is a distortion of assessment data educational stakeholders rush to align their instructional practices to the particular needs of these tests.

The aims of formative and summative assessment are often found in conflict of one another. Leading Finnish educator Pasi Sahlberg describes how formative assessment is designed to grant agency to schools and teachers, as can be seen in places like Finland where teachers enjoy visible levels of trust.<sup>22</sup> Formative assessment operates at the community level, empowering the stakeholders most directly involved in students' learning. In contrast, 'macro' assessments – at both the national and international level - often serve evaluation purposes without advancing the aims of students and teachers. For this reason, Sahlberg is sceptical of the pedagogical value of global learning metrics.

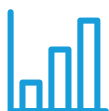
A striking feature of all these concerns is that, while they may take particular aim at global learning metrics, they apply to summative assessments more generally, particularly those attached to high stakes. The tensions between local relevancy and global comparison, while perhaps amplified by global learning metrics, exist at the national level too. Many exam systems have come under attack on the same basis of narrowing the curriculum to focus predominantly on testable knowledge and skills, and for distracting teachers from broader instructional strategies.<sup>23</sup>

To date, global learning metrics have been thought of as an extension of summative assessments, emerging as a statistical construct through a mixture of national and international assessments. The challenge, it seems, is to design global learning metrics in such a way that they harmonise the goals of formative and summative assessment, and that allows for meaningful, contextual comparisons without stifling the local aims of local curricula.



## The five principles

This section explicitly sets out five design principles around which global learning metrics must be developed to achieve their intended benefits as an evaluation mechanism, without incurring the cost of unintended consequences.



### **Data as a by-product of learning**

As long as assessment is viewed as a separate activity to learning and teaching, data collection will inflict an opportunity cost as time and effort is expended on administering, grading and reporting on students' performance. The data upon which global learning metrics are based should instead emerge as an automatic by-product of students' learning.



### **Vertical alignment**

Global learning metrics are of primary interest to stakeholder groups situated outside of the classroom, yet they are ultimately an aggregation of student-level data and intended as a reflection of learning and teaching. The same source of assessment data should serve the multi-faceted needs of students, teachers, program managers, evaluators and policymakers all at once. In particular, the chasm between the formative aims of assessment for teachers and the summative aims for evaluators must be bridged.



### **Context-driven data**

Rather than encouraging policymakers to compete for rank and position as an end in itself, global learning metrics should instead facilitate a global exchange of best educational practices. An educator facing a challenge in one particular environment should be able to lean on lessons learned from other similar implementations worldwide. To ensure that the transfer of best practice is contextualised to each environment, global learning metrics should draw attention to the ground-level realities underpinning observed trends in data.



### **Low stakes**

To avert the distortion effects of politicised assessment, global learning metrics should not have high stakes attached to them. Exams may still have a place as a credentialing mechanism for high school graduates, but their aims should not be conflated with the evaluation purposes of global learning metrics. The anticipation and hype that surrounds reporting of single-point assessments should be substituted for a continual stream of assessment activity for which there is no particular incentive to 'game' the results.



### **As much standardisation as necessary, as much localisation as possible**

Any attempt to draw comparisons between education systems must also leave space for countries to interpret and localise these standards within their own sociocultural context. Global learning metrics should constitute only a subset of the knowledge, skills and attitudes that are promoted and measured within each national context.

These principles, if met, would force a tight coupling between global learning metrics and the learning and teaching they are based on. They would enable a recycling of learning data into ground-level activity, so that we would not only 'know what is possible' but have both the resources and context to achieve those aspirations.

## The role of technology: A case study of Maths Age

The five principles outlined in the previous section offer an idealised view of the uses to which assessment can be put. It is difficult to imagine how they could be realised within the confines of traditional, paper-based assessment models. The affordances of digital technology, however, have given rise to forms of assessment that approximate those principles more closely than ever before.

Since its founding in 2004, Whizz Education has championed global learning metrics as a central component of its adaptive tutoring platform, Maths-Whizz. A comprehensive account of how Maths-Whizz works, and the learning data it generates to support multiple stakeholders at once, can be found in a separate paper.<sup>24</sup> A summary is presented here, from the viewpoint of how these technologies can enable the five principles of global learning metrics.

At its core, Maths-Whizz is a virtual tutor that supports students to learn mathematics according to their individual needs and pace of learning. Each student initially undertakes a diagnostic assessment that is designed to measure their knowledge level across several topics, from which the student's 'Maths Age' is calculated. A student with a Maths Age of 8.5, say, has the mathematical knowledge expected of an eight-and-a-half year old. Maths Age is a criterion-referenced metric that reflects a student's knowledge level in mathematics with respect to an international curriculum developed by educationalists.

For each student, the virtual tutor automatically prepares a learning plan based on their unique assessment profile. As students work through hundreds of interactive maths lessons, the virtual tutor continually assesses their needs, adapts lesson delivery and updates their Maths Age in real-time. Thus, every student engaged with Maths-Whizz has an up-to-date Maths Age that emerges as a by-product of their interactions with the virtual tutor - there is no separate cost attached to data collection.

Whizz's central reporting system aggregates student data at multiple levels to enable stakeholders access to the most relevant and actionable insights into their students' learning as it occurs. A teacher can see, at a glance, the distribution of Maths Age in their class – our data has exposed a multi-year knowledge gap in classrooms across the world, highlighting the need for more differentiated instruction.



**Figure 2**

The spread of learning needs in a typical classroom made visible by Maths Age

Real-time comparisons can also be made between schools, sub-regions and even entire regions. When paired with insights from the ground, this enables a model of continuous course correction, where data informs ongoing, incremental improvements to education programme design (see the white paper, *Data to Insight to Action*, for a case study of how this model has driven transformational learning outcomes in rural Kenya).<sup>25</sup> The data can be stratified along various demographical lines such as gender, school type and geography to identify the most vulnerable cohorts and ensure action is taken at the point of need.

The stakes attached to Maths Age are inherently low. Since the metric is based on continuous assessment, the incentive and means to 'game the system' is vastly diminished as no single assessment has significant consequence for how learning outcomes are measured.

Since 2007, over a million students worldwide, from elementary through to middle school, have been assigned a Maths Age. These students herald from diverse contexts ranging from affluent schools in the US and UK to remote communities in Mexico and rural communities in Kenya, many of them marginalised. Learning metrics such as Maths Age have thus been deployed at a truly global scale.



**Figure 3**

In this comparison chart, each icon denotes a region and the scale represents the average Maths Delta among students (defined as Maths Age – Actual Age). The distribution therefore shows the relative mathematics attainment of Maths-Whizz users in each region. The far-left icon represents the attainment of around 100,000 Kenyan students currently active on Maths-Whizz. The vast majority of those students reside in resource-constrained rural communities, and can be seen to lag around five years behind their peers in other regions (as well as in well-resourced private schools in Kenya). The chart highlights the devastating loss of learning potential that results from the poverty gap.

The scaling of Maths Age to multiple territories has forced Whizz to confront the tension between localisation and standardisation. The resolution comes from the fact that Maths-Whizz is intended as a complement to any specified curriculum rather than a substitute. It provides students with a common knowledge base in mathematics that we have determined to have global relevance. Maths Age is simply a reflection of how students worldwide are progressing towards this common standard. Our research shows that students who spend 45–60 minutes a week on Maths-Whizz can expect to achieve accelerated learning gains towards this global standard.<sup>26</sup>

Significant effort is directed towards adapting the representation of learning content to align with the cultural context of each region. All students are expected to add fractions, for example, though the visual representations for that lesson varies between regions. Thus, while Maths Age is mapped against a global cognitive domain, the manner in which students encounter a concept reflects their cultural norms.

Within each regional and curricular context, there will exist a corpus of expected knowledge and skills not covered by Maths-Whizz. Our implementations are geared towards helping teachers to embed Maths-Whizz as a core layer of their students' learning, and to harness the insights generated by the tutoring system to advance their broader pedagogical and curriculum objectives.

Maths Age serves as proof that it is possible to develop global learning metrics in such a manner that the data itself feeds back into the learning and teaching process. The difference between the formative and summative uses of Whizz's learning metrics is essentially a matter of how student-level data, itself an automatic by-product of students' learning, is aggregated and reported on to different stakeholders. The same data that drives teachers to action in their lesson planning and instruction can fulfil the evaluation aims of global learning metrics. Furthermore, once we recognise that global learning metrics need not capture the full breadth and depth of learning, the goal of cross-national comparison can exist in harmony with local curriculum and cultural requirements.

## Reshaping the conversation around global learning metrics

The debate around global learning metrics is unlikely to abate on account of a single case study. Our aim in writing this paper, instead, is to inspire new thinking around data collection for SDG 4. We share many of the concerns expressed around the use of global learning metrics: at their worst, they threaten to amplify the risks of high-stakes summative assessment. Yet we remain persuaded by the premise of a global standard against which education policies and practices can be benchmarked.

Traditional assessment practices seem to give rise to trade-offs between the summative and formative aims of assessment, creating conflicts between evaluation and the learning and teaching it is based on. The affordances of digital technology promise to resolve many of these trade-offs. We have presented the example of Whizz's own proprietary global learning metric, Maths Age, to demonstrate that the tensions between formative and summative assessment, and between local and global education standards, can be reconciled with deliberate use of technologies like virtual tutoring.

Technology itself is no free lunch, and brings its own monumental challenges and unintended consequences, the most obvious of which relate to access and infrastructure. Moreover, even if formative assessment tools of the kind described above were embraced by policymakers across the world, consideration would need to be given to how the offerings of multiple providers and platforms would be quality assured and mapped to the standards upon which global learning metrics are based. A regulatory body might be needed to undertake such an effort, which itself could prove a costly endeavour.

The scope for global learning metrics must ultimately extend far beyond cognitive domains like mathematics to capture the full picture of what is happening in education systems worldwide. The World Bank, for example, has explored methodologies for combining learning metrics with outcomes in health to develop a 'human capital index'.<sup>27</sup> And even at Whizz, we are still scratching the surface on defining and implementing meaningful metrics to capture the quality of teaching, as well as higher-order cognitive skills like problem solving.

We hope that as education stakeholders co-opt notions of global learning metrics, they will keep in mind the five principles we have outlined here and that they hold any delivery mechanism, technology-enabled or otherwise, accountable to that standard. With the principles in place, investment in data represents an investment in learning and teaching.

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