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WORKING PAPER

Invest: Harnessing the latent potential in African education systems

Synthesis of UNICEF Innocenti research on education in Africa

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Executive summary

The African Union has dedicated 2024 as the Year of Education, seeing it as an opportunity to regalvanize member States towards the achievement of their education goals. The building of stronger, more learning-focused education systems is urgently needed on the continent. Africa has a growing population of young people: by 2030, Africa's under-18 population will increase by 170 million to 750 million and will reach 1 billion by 2050, accounting for 40 per cent of the under-18 population globally (UNICEF, 2017). Ensuring that these children and young people receive the education to gain the skills needed for them to succeed in ever-evolving societies and economies is essential not just for the continent but for the world.

As Africa continues its demographic shift, it is also more critical than ever that education systems are built to be resilient to shocks and emergencies. In Africa, 39 out of 54 nations are at high risk of climate and environmental shocks.[1] The immediate environmental disasters related to climate change directly affect and shut schools due to dangerously high temperatures or extreme weather events, droughts and floods, but they also contribute to increases in conflict and violence, further putting children and their education at risk.[2]

Improving the efficiency and quality of education systems and building resilience are not competing goals. On the contrary, investing in programmes to improve education quality and access can also increase system resilience.

This paper examines a crucial question facing African education systems today: How can governments invest in under-resourced areas to transform education systems, improving their outcomes and enhancing their resilience? To address this question, the paper focuses on three key areas of latent potential for impact: early childhood education (ECE), targeted instruction for vulnerable children, and education technology (often referred to as 'EdTech'). These focus areas were selected based on their significant but underused potential to address critical challenges in the continent's education systems:

1. **Early childhood education** lays the foundation for lifelong learning. Strengthening the foundations of learning through quality ECE has been shown to improve outcomes for children, their families and society more broadly. Improving ECE has also been found to increase resilience by preparing children and families to continue learning during disruptions. However, less than one third of preschool-age children are enrolled in ECE.[3] Public investments in the ECE sub-sector remain low in most of the continent. ECE needs to be made a priority for African governments and their partners, with embedded quality monitoring as the sector expands.

2. **Targeted instruction for vulnerable children** addresses issues of equity and inclusion, to help ensure that no child is left behind. There are close to 100 million primary and secondary school-age children out of school across Africa.[4] Vulnerable children across the continent – including those in emergencies, from low-income households, in rural and remote areas, and those with disabilities – are far more likely to be out of school or behind when in school and at risk of dropping out. Targeted instruction through remedial, bridging, catch-up and accelerated programmes can improve learning outcomes, reduce repetition and dropout rates, and strengthen the links between

formal and non-formal education systems. These programmes can alleviate the influence of structural inequities on education systems. Strengthening these systems also supports system resilience by providing learning continuity during times of crisis and support bringing out-of-school children and youth into formal education as part of the recovery process.

3. **Education technologies** in teaching and learning can enable flexible and personalized learning for students. Recent experience from the COVID-19 pandemic also illustrates their importance in enabling learning continuity. Governments should build on the continent's ongoing digital transformation, while ensuring that such transformation does not worsen the already large gaps in who is able to benefit. This is important to not only support resilience in education to shocks but also to future-proof African education systems for a rapidly changing and digitalizing global economy. African governments have expressed a strong desire to capitalize on digital learning, but continuing investments in this area should be accompanied by low- and no-connectivity options, and a focus on integrating education technology within the broader education system.

Overall, the investment argument for growing these areas of latent potential have three broad implications for African governments and their partners.

First, government investments need to leverage what already exists and be fit for purpose to address challenges. Successful community-led and small-scale interventions can be expanded and more permanently embedded into the education system, with careful consideration of design and implementation (this topic will be delved into further in the final paper of this series). Utilizing multiple approaches, including a combination of targeted and mainstream programming, can help make interventions accessible to a wider group of students.

Second, equity should continue to be at the forefront of any new investments. Lessons from recent and past crises found that the children who were most vulnerable prior to a crisis are also most likely to be the most significantly impacted. Growth in access to ECE and technology has been largely inequitable – and without dedicated equity-focused efforts, further growth in these areas risks worsening inequities.

Third and finally, data and monitoring should be embedded into the design of policy and programme interventions to strengthen resilience, and to allow governments and their partners to learn from what is working and what is not working. The available evidence is clear that not all approaches are made equal. The mere provision or expansion of access to support, ECE or education technology programmes is not enough. Understanding what is working and what is not working is necessary to ensure that policy or programmatic interventions achieve their intended goals.

Introduction

In dedicating the year of 2024 to education, the African Union saw an opportunity to regalvanize member States towards the achievement of continental and international education goals. Included among the year's focus is transforming education in the recovery from COVID-19.[5] In their national statements of support for Sustainable Development Goal (SDG) 4, 40 per cent of African countries made commitments to support COVID-19 recovery and to tackle the issues exacerbated by the pandemic, accelerating the transformation towards more resilient and effective education systems.[6]

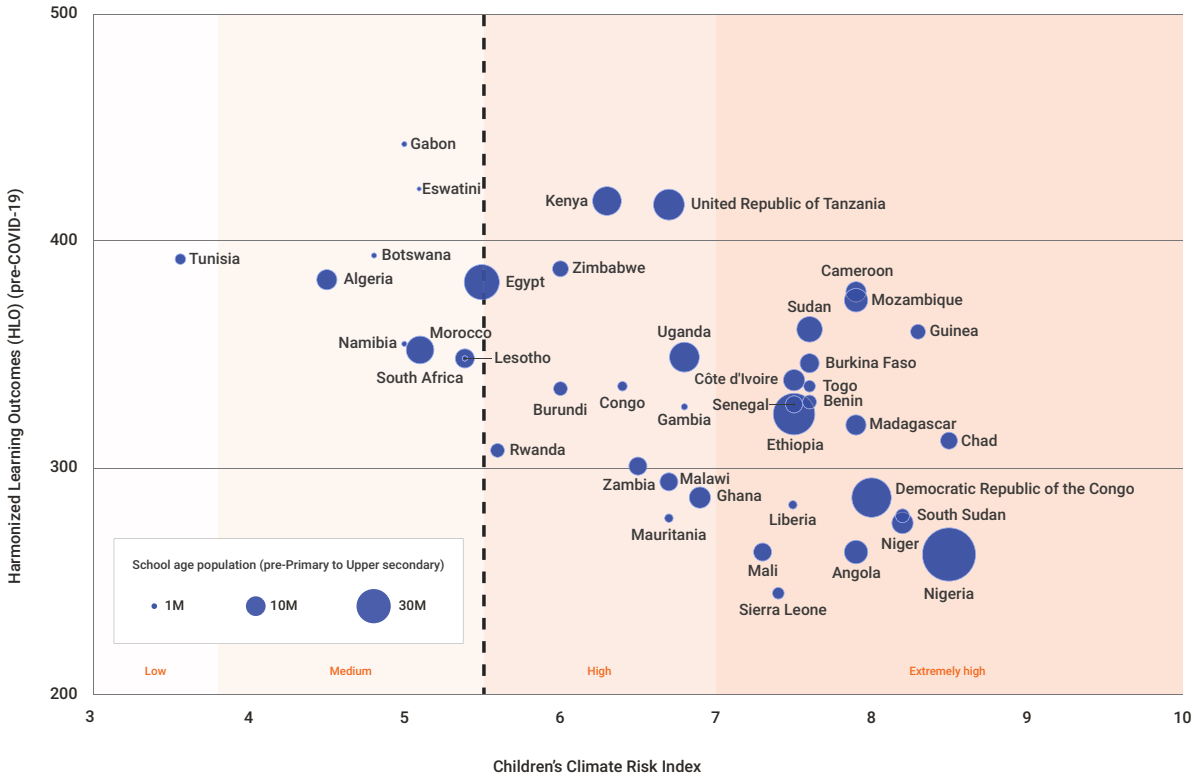
- Africa has a growing children and youth population.
- Education is needed to ensure that children have the chance they deserve.
- Resilience needs to be built into these systems to ensure that they continue in the face of disruptions caused by conflicts, health crises and climate change.

Building stronger, more learning-focused education systems that are resilient to shocks is urgently needed on the continent. Africa has a growing population of young people: by 2030, Africa's under-18 population will increase to 750 million, and will reach 1 billion by 2050, accounting for 40 per cent of the under-18 population of the world (UNICEF, 2017). Ensuring that these children and young people receive the education and skills needed for them succeed in ever-evolving societies and economies is essential – not only for the continent but for the world.

It is also more critical than ever to have education systems and programmes that are resilient to shocks and emergencies so that children may continue to receive the learning and psychosocial support that school and education provides, even when a crisis hits. This is increasingly urgent due to the damaging effects of climate change, which put 39 out of 54 African nations at high risk of climate and environmental shocks.[7] Disasters related to climate change not only affect and shut schools directly due to dangerously high temperatures or extreme weather events, but also spark other crises such as drought and further conflict, further putting children and their education at risk.[8] In a 2023 survey, however, only 10 of 23 African countries with high or extremely high risk of children's vulnerability to the impacts of climate change reported that the government had taken concrete steps to advance greening education (UNICEF, 2023).

Furthermore, over half of the world's crisis-affected children live in sub-Saharan Africa, and one in four crisis-affected primary school-aged children are out of school.[9] Challenges faced by countries often overlap. Countries facing the greatest climate risk, for example, also have some of the lowest levels of learning and are the most in need of resilient education systems that can provide children with learning during any crisis (*see Figure 1*).

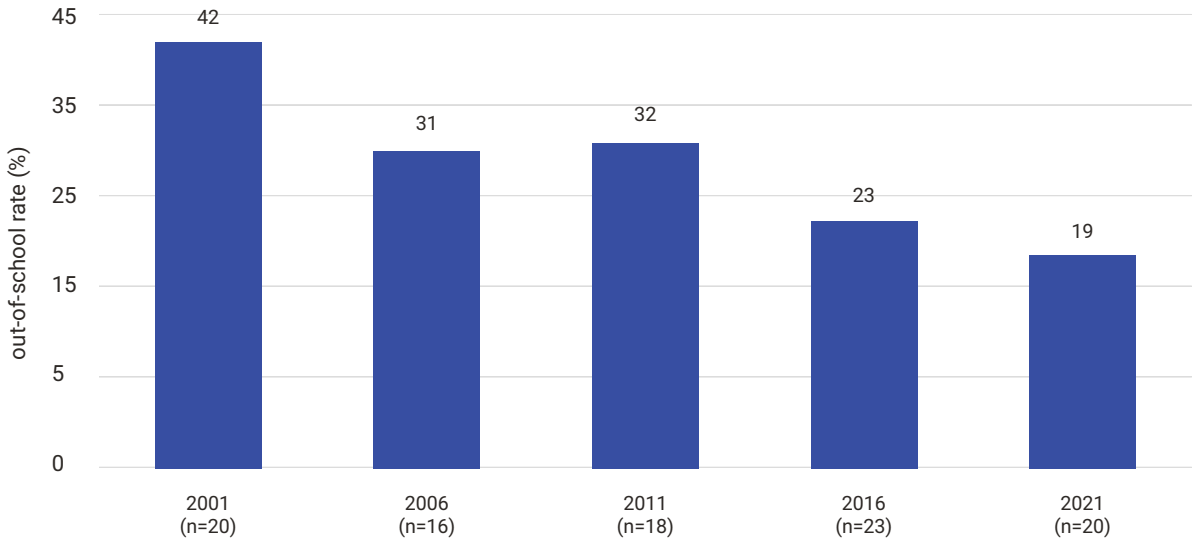
Figure 1: Relationship between student-teacher ratio on learning



Source: UNICEF, Reopening with Resilience.[10]

The first paper in this series[11] focuses on how governments can optimize their existing investments in the education workforce, infrastructure and curriculum. This second paper focuses on opportunity: currently under-resourced areas that are ripe for investment to transform education systems to improve foundational learning. The continent has seen a dramatic increase in access to education over the past two decades, including by bringing out-of-school children and adolescents into the education system (*see Figure 2*).

Figure 2: Out-of-school children rate for primary and lower secondary school age in Africa



Source: UNESCO Institute for Statistics, 2024, Out-of-school children and adolescents of primary and lower secondary school age and school-age population, primary and lower secondary education, <https://data.uis.unesco.org/#>, data extracted on 26 May 2024 09:59 UTC (GMT) from UIS.Stat.

Note: The N represents the number of African countries with data within each year.

This paper argues that governments can build on their successes and strengthen the equity and resilience of their education systems by turning their attention and investment to three sources of latent potential: (1) early childhood education; (2) support programmes for the most vulnerable students; and (3) education technology. For each of these areas, this paper examines why they are an important element of an equitable and resilient education system, the extent to which they are currently lacking in the continent's education systems, and how governments can take advantage of them.

Early childhood education

The need to invest

By 2035, 1 in 3 of the world's children under 5 years old will be in Africa.[12] With more than 85 per cent of brain development taking place by the time a child is 6 years old, the early years are a critical window of opportunity to build the foundations of learning and develop skills to help children succeed in school.[13] Children's early life experiences play a role in whether these connections form a sturdy or a fragile foundation for the learning that follows. Governments must do their part to prepare to nurture the continent's growing number of youngest citizens at this all-important period of brain development.

A large global evidence base, including from Africa, has shown that quality education in the early years contributes to positive outcomes for children, families, the functioning of the education system and society as a whole. For example, a meta-analysis of more than 50 rigorous studies from 19 low- and middle-income countries found significant impacts of pre-primary education on children's cognitive skills, executive functioning, social-emotional learning and behaviour, both during and beyond the pre-primary period.[14] A review of 20 types of frequently used education polices determined that universal ECE provision is the most effective practice to improve learning access and outcomes.[15] Consistent with this evidence, the Global Education Evidence Advisory Panel, which includes top education experts from around the world, rated quality pre-primary education for children age 3 to 5 years as a 'Good buy' in its ranking system of cost-effective education interventions, noting that high-quality pre-primary education has the potential to improve learning outcomes and provide long-term economic benefits.[16]

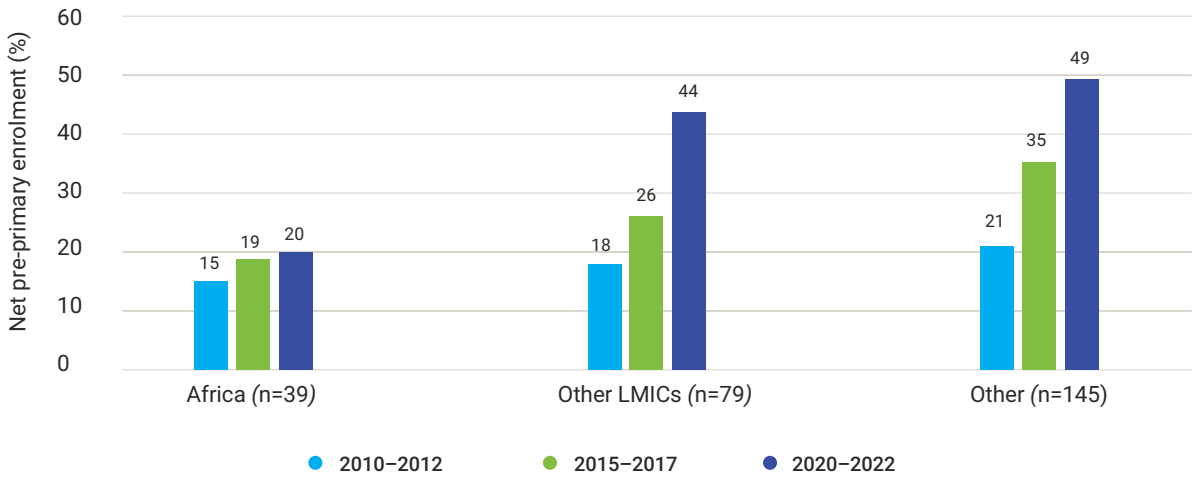
Investing in pre-primary education increases the efficiency of education systems, by providing children with these foundations for learning as they start primary schooling. In Uganda and Madagascar, for example, pre-primary attendance is linked to successful progression through primary schooling.[17,18] Regional learning assessment results from Africa also found that attendance at pre-primary education was positively linked to student learning outcomes in primary school.[19] These returns to pre-primary education are substantial for countries. An increase of 10 percentage points in the pre-primary enrolment rate is associated with an increase of 0.14 years of schooling and a 0.55 per cent reduction in primary school repetition. On this basis, UNICEF estimates that every US$1.00 spent on pre-primary education results in over US$9.00 of benefits to society.[20]

Pre-primary education can also contribute to resilience against future crises in education systems. In Ethiopia, evidence from before and after COVID-19 found that children who had experienced pre-primary education suffer smaller degrees of learning loss;[21] while in Ghana, children who attended higher-quality ECE at age 4 or 5 years had greater engagement in remote learning during school

closures.[22] Efforts to address pre-primary enrolment gaps can, therefore, also ameliorate the long-term impact of crises on the youngest learners, as well as contributing to the resilience of the education system.

Despite this overwhelming evidence on the human capital, societal and economic returns to investment in pre-primary education, however, the sub-sector remains tragically under-resourced. In 2021, 15 out of 24 countries with available data in Africa reported net pre-primary enrolment rates of less than one third.[23] In the context of limited domestic resources, many governments in the continent are not prioritizing ECE. Only around 25 per cent of African countries included commitments to improving early childhood care and pre-primary education in their national statements during the 2022 Transforming Education Summit, compared with 45 per cent of countries outside of the region.[24] Except for a few countries, pre-primary enrolment rates for children in Africa have largely stagnated in recent years. The average net pre-primary enrolment rate for African countries grew at a much lower rate even when compared with other low- and middle-income countries (*see Figure 3*).

Figure 3: Net pre-primary enrolment rates, 2010–2012 to 2020–2022



Source: Adapted from UNESCO Institute for Statistics, SDG 4 February 2024 release, <http://sdg4-data.uis.unesco.org/>, extracted 15 May 2024. Net enrolment rate, pre-primary, both sexes (percentage) and school-age population, pre-primary education, both sexes (number). Enrolment rates are weighted by size of pre-primary school-age population. Country designations based on African Union membership and World Bank income classification.

Note: The N represents the number of countries with data within each year and category.

Furthermore, according to representative household survey data, access to pre-primary education is uneven within countries, with lower attendance among children in rural areas compared with those in urban areas and lowest attendance among children in the lowest wealth quintile.[25] Government investment in pre-primary education on the continent is low. Analysis from the *Transforming Education in Africa report*[26] showed that, on average, only 3 per cent of government education expenditure is allocated to pre-primary. For some countries, this level is at or close to zero. With the relative lack of investment, and high potential for impact and returns, there is plenty of room for growth and acceleration of long-term outcomes from investing in ECE. However, when investing in ECE with scare resources, the choice of what type of ECE programme or policy to invest in becomes all the more important.

What to invest in

Based on a review of existing research and evidence from across Africa, several key areas have emerged as priorities for investment in ECE. These include focusing on quality, implementing context-appropriate ECE approaches, and investing in workforce capacity and teaching-learning materials. While these areas represent critical foundations for effective ECE systems, it's important to note that – as education systems progress and initial gains are made – additional areas for investment may come to the forefront. The following sections explore these priority areas in detail, providing insights from various intervention studies across the continent.

Invest in quality

A UNICEF Innocenti systematic review identified 17 studies on pre-primary education interventions to improve schooling and learning outcomes, representing 10 countries in Africa.[27] Approximately half of the interventions studied looked at the impact of expanding pre-primary education provision or compared the impact of different types of provision. Overwhelmingly, these studies found positive impacts on learning and schooling.

The impact of enrolment in pre-primary education, however, varied by programme characteristics and by the environment that children would have received if they had stayed at home instead. An assessment of the introduction of one year of pre-primary in South Africa, for example, showed positive effects on children among higher-performing schools and provinces only,[28] because they were better placed to provide high-quality programming. Meanwhile, in the Gambia, community-based early childhood development centres were found to have a negative effect on children from more advantaged households, something the authors attributed to them experiencing a higher-quality home environment compared with the relatively lower-quality offering in the centres.[29] In short, expanding access to pre-primary education is just the first step: quality matters. Governments will need to significantly increase their spending per child enrolled to meet key quality goals.[30]

UNICEF Innocenti's systematic review of what works in pre-primary education did not identify any studies from Africa which focused on quality assurance mechanisms as an intervention to improve pre-primary education outcomes. In a couple of instances, however, quality assurance was qualitatively recognized as an intervention component that can influence its impact on children's outcomes. In the Gambia example above, for example, pre-primary programmes annexed to primary schools were associated with more positive outcomes than community-based early childhood programmes. This difference of impact by programme type was partially attributed by the study's authors to monitoring: while the annexes fell under the monitoring and quality control schemes of the primary education system, the community-based early childhood programmes did not.[31] Meanwhile, in Tanzania, public pre-primary sites implementing new high-quality, multimedia-based curricular materials were visited by programme officials on at least three unannounced occasions, which the study authors noted as contributing to their positive outcomes.[32]

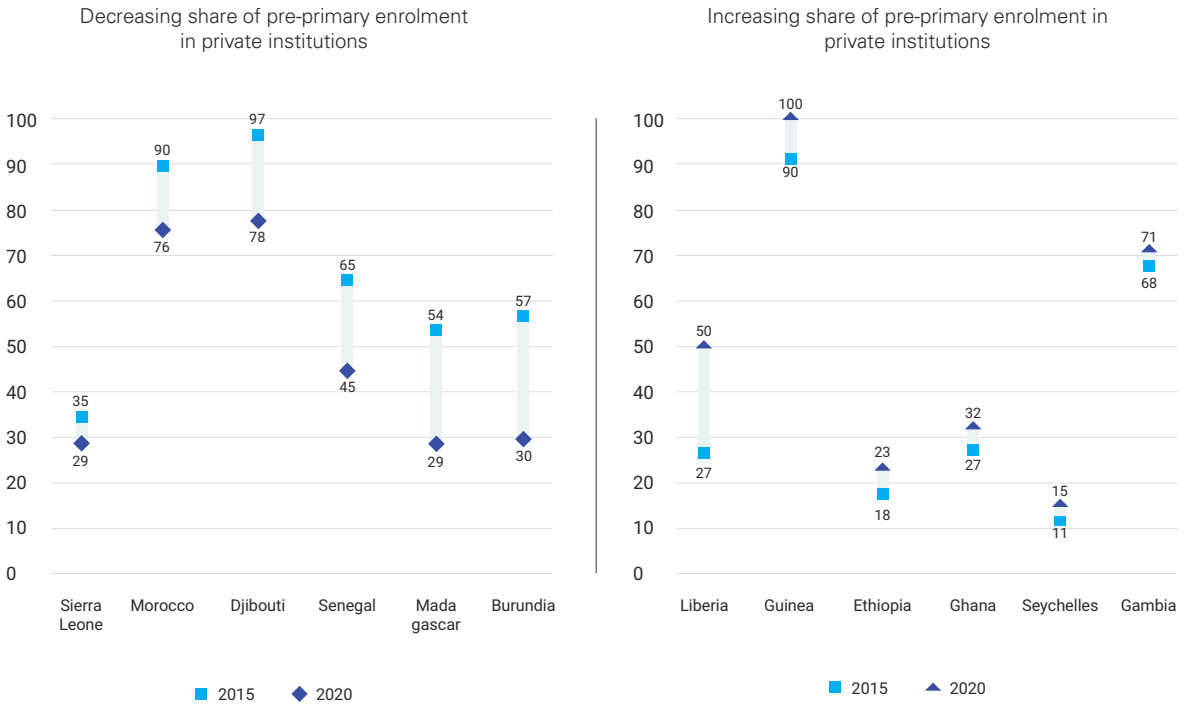
Invest in context-appropriate ECE approaches

While many countries in Africa have seen ECE expand through public investment or primary school system infrastructure, in others enrolment increases have occurred through community-based approaches (*see Figure 4*). The existing evidence suggests that both approaches can effectively expand ECE access and improve outcomes for children, if quality standards are met.

Community preschool models use a community-based approach to expand ECE and incorporate elements such as community school committees, community funding models and upskilling community members.[33] UNICEF Innocenti's systematic review concluded that community-based ECE can positively impact child development outcomes if minimum quality standards are met.[34] In Mozambique, a community-based preschool expansion model implemented in rural areas significantly improved children's cognitive, communication, fine motor and social-emotional skills.[35] The programme included teacher training for local community members, learning materials, monthly parenting meetings and community-led school committees.[36] School-based approaches, such as adding pre-primary classes to existing primary schools, have also shown positive results in Ghana. In Madagascar and Senegal, where much of the growth in pre-primary enrolment has been driven by the public sector (*see Figure 4*), primary school students who had attended ECE outperformed those with similar backgrounds who had not.[37]

Having clear quality standards in any approach is, again, crucial. In the Gambia, newly constructed community-based early childhood development centres were found to be more accessible to parents than a programme delivered as annexes to local primary schools, because of easier drop-off and pick-up by parents. However, the community-based centres had lower-qualified staff than the primary school-based programme and lacked a clear monitoring system, which contributed to the programme not leading to significant improvements in children's developmental outcomes.[38] Community-based ECE provision can vary greatly so it is important for quality-focused interventions to respond to their specific needs. Studies from Kenya and Malawi found that teacher training interventions in community-based ECE programmes required additional components such as instructional materials or parenting support to show positive impacts.[39,40]

Figure 4: Share of pre-primary enrolment in private institutions, 2015–2020



Source: Source: UNESCO Institute for Statistics, Percentage of enrolment in pre-primary education in private institutions, 2024, <https://data.uis.unesco.org/>, data extracted on 10 January 2023, 08:14 UTC (GMT) from UIS.Stat.

Note: In Liberia, the increase in private enrolment share was not accompanied by an increase in overall pre-primary enrolment rate over the same period,[41] as it reflects the outsourcing of some pre-primary and primary schools to private operators.[42]

The evidence base provides examples on ECE programming of different durations that were able to positively impact children's outcomes.[43,44] The two-year community-based ECE programme in Mozambique led to significant improvements in a range of children's development outcomes[45] and the construction of another 350 community-based ECE centres.[46] With budgetary pressures slowing down the scale-up's implementation, an accelerated eight-week school readiness programme in another province of the country was also evaluated to have substantial benefits on children's developmental outcomes.[47] Importantly, both programmes retained the importance of teacher capacity building and parent education sessions. The intensity of daily programming also matters. A study in Zambia found that three to five hours per day may be more effective than shorter or longer days in improving various developmental domains (McCoy et al., 2017). Ultimately, the optimal approach depends on the specific country context, existing education system and available resources. Governments need to balance trade-offs between coverage and intensity based on their particular circumstances and goals, while focusing on quality and equity in provision.

Identifying and implementing context-appropriate ECE approaches can be significantly enhanced by integrating research into reform efforts and building on what has worked in similar contexts. The next paper in this series delves further into this process, highlighting the importance of implementation planning, clear mandates for all actors, context-responsive resourcing, and the use of data and research for continuous improvement. By applying these principles to ECE initiatives, policymakers and educators can more effectively identify, adapt and scale context-appropriate approaches that meet the unique needs of their communities and education systems.

Invest in workforce capacity and teaching-learning materials

The pupil to trained teacher ratio in pre-primary education in sub-Saharan Africa is 54:1.[48] There is an urgent need to recruit more pre-primary teachers as well as provide quality training to existing educators, with evidence from several African countries demonstrating that well-designed workforce interventions can significantly improve the quality of pre-primary education.

Workforce interventions, largely in the form of training for teachers or community volunteers, were the most frequently studied form of intervention to improve learning quality for children in pre-primary education in Africa. Evidence from Ghana, Kenya and the Gambia supports the central role of pre-primary educators in children's learning and development. In the Gambia, providing training to teachers on implementing a new play-based curriculum increased fine motor skills among children who started out with the lowest skill levels.[49] The training in these examples also took place as multiple sessions over several months to a year. Notably, in Ghana and Kenya, teacher training was combined with the training of local government officers to provide teachers with ongoing classroom coaching, and these saw significant impact on children's outcomes.[50,51] As noted in the first paper of this series, the need for providing high-quality training and ongoing support for teachers is great, and nowhere is it more needed than in ECE education where it is sorely under-invested in.

Providing early learning lesson plans, materials and strategies to teachers supports the quality of ECE programming and can also have an impact on children's outcomes, especially when combined with teacher training. For example, a six-week multimedia intervention delivered by preschool teachers in Tanzania showed a positive impact on children's cognitive skills, social skills and health knowledge.[52] It consisted of radio and television shows, storybooks, and teacher and parent guides adapted or developed in partnership with Tanzanian educators and producers; participating teachers notably

received sufficient training in using the materials. Meanwhile, adding teacher guides and instructional materials to a related teaching and coaching intervention produced greater impact than training and coaching alone in Kenya.[53] Conversely, a short curricular intervention with limited training for teachers did not make a difference on children's executive skills, also in Kenya.[54] In short, for each of the programmes mentioned, training and support to teachers matter.

What to consider when investing in ECE

How ECE interacts with positive learning stimulation at home

Overall, the findings above highlight the interaction between the quality of ECE programming and children's home environment. The impact of ECE interventions is significantly influenced by their interaction with families' socioeconomic status, particularly in terms of parental education levels and resources available at home. In many African countries, the lack of learning materials at home is pronounced. Household survey data found that in Burundi, the Central African Republic, Chad, the Democratic Republic of the Congo, Guinea, Guinea-Bissau, Mali, Senegal and Togo, less than 1 per cent of children under 5 years old live in households with three or more children's books.[55] The lack of learning materials at home, particularly in West and Central African countries, underscores the critical role that quality ECE programmes can play in providing early learning opportunities for children who do not have access to supportive materials at home. In some contexts, children may benefit less from ECE interventions if the programme quality is lower than what their home learning environment can provide, as in the Gambia example discussed above.[56] In other contexts, however, more advantaged children may also have access to higher-quality ECE provision, furthering inequities, as was observed in South Africa.[57]

An important implication of this interaction is that ECE interventions need to be carefully designed to take account of levels of capacity and resources of parents and the broader community around the children. Fortunately, training can also help overcome parental capacity gaps. There is a strong evidence base, for example, for the use of parent training on early childhood stimulation, with benefits found in both the short and long term.[58] However, in Ghana, parental awareness training returned negative outcomes for children, persisting for a year among children from households with a non-literate male head.[59] The Ghana study's authors posited that parents with less education were more likely to disagree with the messages around play-based learning from the meetings, and male parents felt more empowered to attempt to counter at home the changes in teaching practices or push back on teachers not to use the methods.

How ECE interacts with gender equality

Another UNICEF Innocenti evidence review showed that early learning has significant transformational power to tackle gender inequities for children, but existing pre-primary education provision often fell short in delivering on this potential.[60] The Ghana study findings on parental engagement above, however, serve as one example of the importance of considering the gender dimension in designing ECE interventions. In another contextual example from Ghana, male pre-primary teachers are significantly more likely to be regularly absent from school (42 per cent) compared with female pre-primary teachers (9 per cent),[61] on top of already being under-represented in the pre-primary teaching workforce (only 15 per cent of pre-primary teaches in Ghana are male).[62]

ECE not only provides an opportunity for high social returns through outcomes related to improved learning, and related benefits for children and young people, but also provides an opportunity to support gender equality. The design of ECE programmes, however, should be responsive to and address the prevailing gender norms and inequities. One approach is to use the Gender-Responsive Pedagogy in Early Childhood Education (GRP4ECE) toolkit, developed by non-profit organizations VVOB and FAWE and endorsed by the African Union and UNESCO's International Institute for Capacity Building in Africa (IICBA). The capacity-building approach has been piloted in South Africa and Zambia[63] and the resources are available for self-use, including for teachers and school leaders.[64]

The need for data to optimize ECE investments

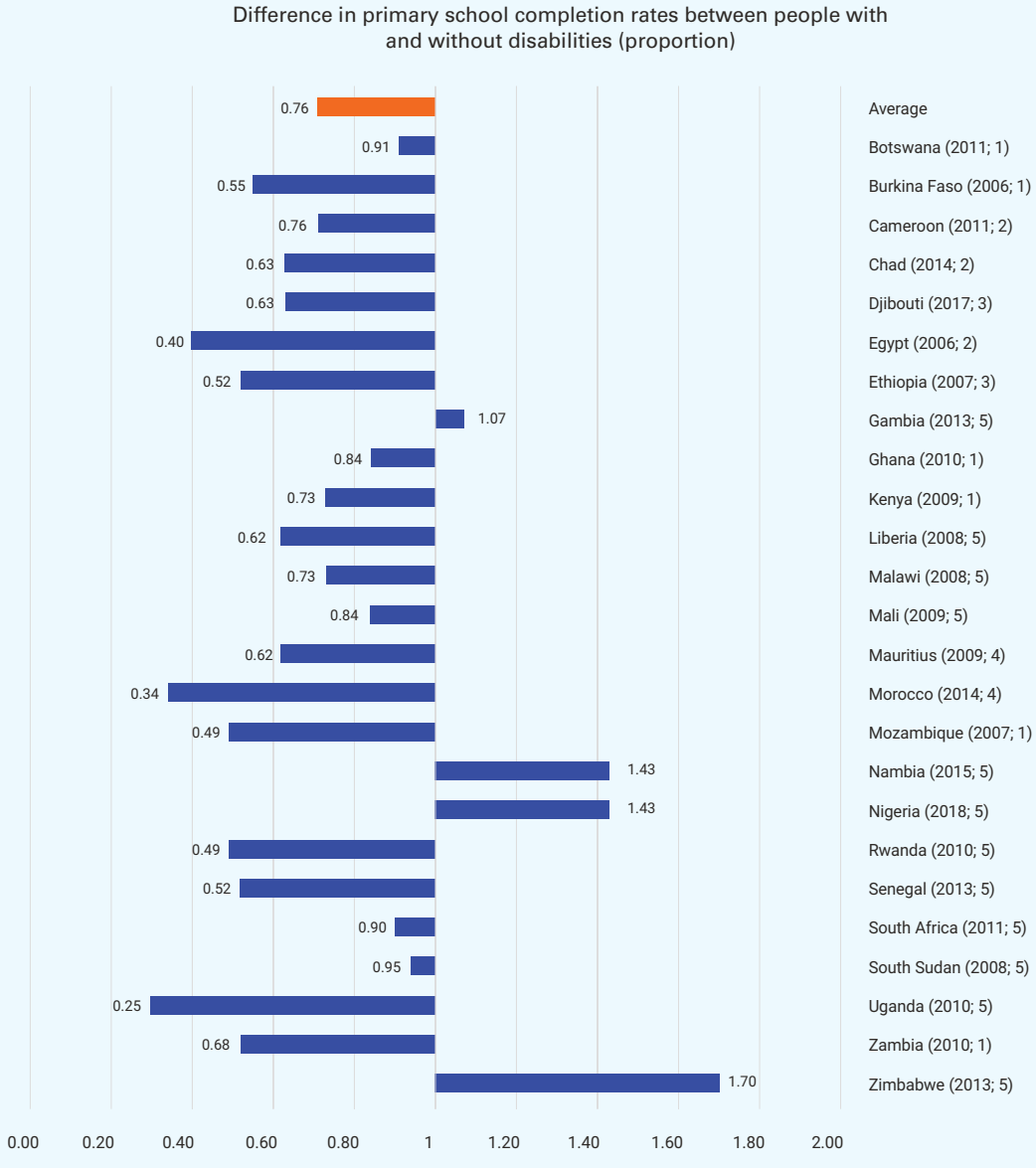
There is a great need for data and evidence to inform investments in ECE in Africa – including to choose and design the most appropriate programme designs for different contexts and to serve the needs to diverse groups of children and communities. However, there are limited data and research to understand education in the early years from the continent. A review of education datasets collected between 2010 and 2022 across three data repositories found that only 68 datasets were on sub-Saharan Africa, and only 2 per cent of these addressed pre-primary education.[65] Similarly, analysis of the African Education Research Database found that only 2 per cent of funded research in sub-Saharan Africa addressed ECE.[66]

This lack of data and research is particularly evident when examining how ECE can support inclusive learning for all children. For example, few studies in the UNICEF Innocenti systematic review discussed the interaction of ECE interventions with ethnic and linguistic diversity. None provided any information on participants' disability status, expect for one study where children with disability were excluded.[67] This knowledge gap is significant given the importance of early intervention to support education inclusion for children with disability (this topic is discussed further in Box 1).

Box 1: Spotlight on disability-inclusive education

The inclusion of children with disabilities is a priority for a majority of African countries. In their statements in support of SDG 4, 61 per cent of African governments included commitments to accommodate the specific requirements of students with disabilities.[68] A UNICEF Eastern and Southern Africa Regional Office (ESARO) progress report[69] found that 15 out of 21 countries have inclusive education provisions for children with disabilities in their education laws and policies. However, most do not articulate the necessary educational support to integrate children with disabilities in mainstream classes and special education is the most dominant approach in the region.

Globally, disability remains a significant factor for education vulnerability and exclusion: children with disabilities are estimated to make up a third of the world's out-of-school children.[70] Across Africa, children with disabilities lag behind those without disabilities in primary and secondary education,[71] with schooling completion rates being significantly lower among people with disabilities in most countries with available data (*see Figure 5*). Young children with disabilities are also less likely to attend ECE than their peers without disabilities, including in African countries where data are available.[72] This challenge extends beyond sub-Saharan Africa. For example, in Egypt, the literacy rate for persons with disabilities aged 10 years and over is only around 50 per cent.[73]



Despite policies moving in the right direction, workforce, curriculum and infrastructure spending in the region do not adequately include support for the inclusion of children with disabilities in schools. In the Eastern and Southern Africa region, nearly all countries have provisions for the accessibility of school buildings for children with disabilities, but the application of Universal Design in building construction is yet to be mainstreamed in most countries.[74] About half of countries have inclusive and special education included in pre-service courses and programmes, but only a few have continuous inclusive education initiatives for in-service training. Outside of the region, a survey of over 700 teachers in Djibouti found that fewer than 5 per cent have had any training in disability-inclusive education (UNICEF Innocenti, forthcoming). A lack of training and appropriate teaching and learning materials are the main challenges the teachers reported. Prevailing attitudes towards disability more generally, including those held by teachers themselves and by parents of children without disabilities, are also an important barrier that needs to be overcome.

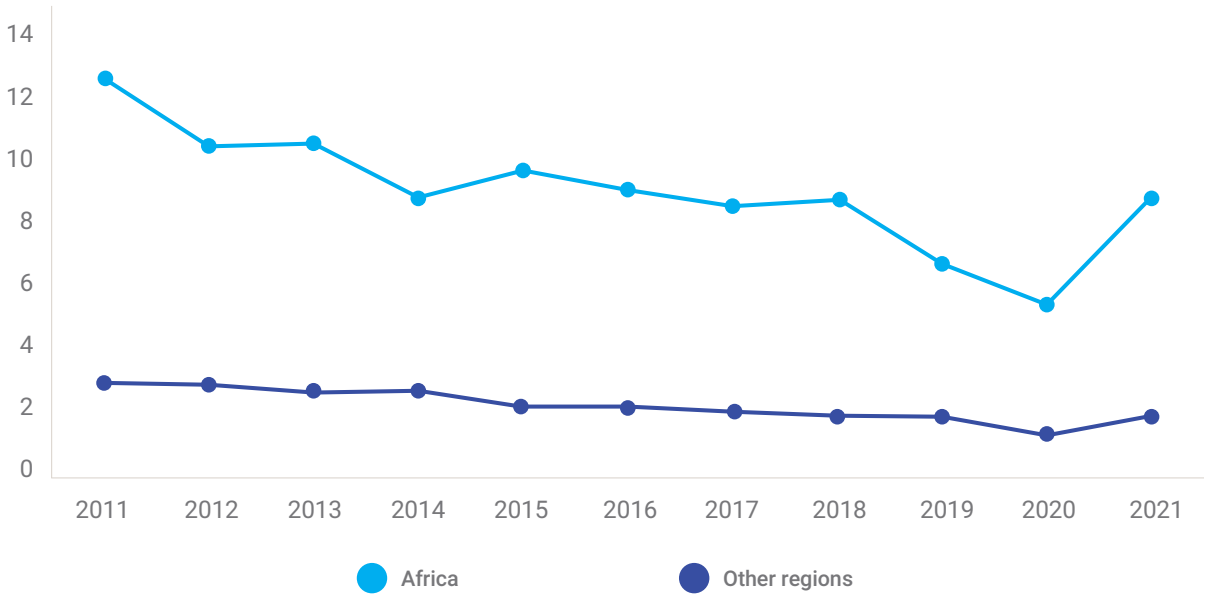
Disability-inclusive approaches should also be integrated into the investment areas discussed in this paper. While many countries in the region reported making adjustments to remote learning materials used in their COVID-19 responses,[75,76,77] there is still limited evidence on the role of education technology in supporting inclusive education of children with disabilities, including refugee children.[78] A review of remote learning approaches in the Central Sahel region found a lack of consideration for the inclusion of children with disabilities.[79] ECE faces an even larger gap: none of the 17 studies in UNICEF Innocenti's review mentioned disability except to note the exclusion of children with disability from the study.[80] There are, however, pockets of promise. Accessible digital textbooks (ADTs) allow all learners, including those with disabilities, to access the same curricular content as other children and an initiative to implement them is under way in Kenya, Rwanda and Uganda.[81] An inclusive, home-based ECE programme has a structured approach to enabling young children with disabilities to join their peers in play-based learning, and 30 such centres are being implemented and studied in Kenya, Uganda and Zimbabwe.[82] Consistent with this overall paper, more data and research are needed to identify promising approaches and scale them up.

Providing education tailored to the needs of vulnerable children

The need to invest

Close to 100 million children of primary and secondary school age in sub-Saharan Africa are out of school.[83] Despite substantial progress towards universal schooling, one in five primary school-aged children remains out of school, while nearly half of the upper-secondary population is excluded from education, with this number continuing to rise.[84] Even among children who are in school, many are at risk of dropping out or not progressing. While the school repetition rate among African countries has seen a decrease over the past decade, it is still considerably higher compared with other regions. In 2021, the average African country's primary school repetition rate across all grades is 9 per cent – still more than four times higher than the average repetition rate across non-African countries (*see Figure 6*).

Figure 6: Trends in average repetition rates among African countries compared with other regions



Source: UNESCO Institute for Statistics (2024). Repetition rate in primary education (all grades), both sexes (%), defined as proportion of pupils from a cohort enrolled in a given grade at a given school year who study in the same grade in the following school year.

Analysis in the *Transforming Education in Africa* report[85] found that Africa is the world's least efficient region in using education funding. A major source of inefficiency is the continent's high repetition rates, which leads additional expenses for repeating students.[86] Burundi, Comoros, Malawi and Namibia, for example, spend more than 15 per cent of their annual basic education budget on repetition.[87]

School repetition also exerts a cost on students. Longitudinal studies in Ethiopia and Senegal have found a link between repetition and subsequent dropout,[88,89] even when comparing students with similar ability levels.[90] Longitudinal research from Mozambique also finds this relationship, with repeating a grade associated with a 4 per cent higher probability of dropout.[91] Repetition is not always reflective of student ability. Analysis of Education Management Information System (EMIS) data in Niger, for example, found that promotion rates in primary schools were not correlated with student ability levels as measured by national assessment scores.[92] Longitudinal studies based on data from Rwanda, Senegal and Côte d'Ivoire also found that students who repeat a grade are not necessarily those with the lowest academic ability.[93,94]

Recent analysis has also concluded that there are no clear data to support that having children repeat a grade is helping children to catch up. The analysis instead suggests that governments should focus on other available options such as one-off catch-up programmes or regular remedial classes, and addressing early learning through pre-primary education programmes.[95] This idea is widely known to teachers in the region. For example, teachers in Cameroon and Ghana have linked the challenges in promoting students to the lack of remedial and supplementary support:[96,97] perhaps it is time to listen to the teachers.

This section examines targeted instruction approaches to support vulnerable children who are excluded from the education system or at risk of dropping out. Some groups of children are disproportionately affected by vulnerability to exclusion and dropout, including children living in contexts of crisis and conflict,[98] children with disabilities,[99] children from low-income households[100] and children in rural areas.[101] This section explores effective strategies for providing tailored support to vulnerable children across different contexts in Africa.

What to invest in

As explored in the first paper in this series,[102] maximization of instruction time and improving pedagogical practices are both highly correlated with improvements in student learning. Both the amount of time a teacher has with a student and what the teacher does with that time are incredibly important. Some examples of common programmes types are shown in *Table 1*.

Table 1: Programmes to support the most vulnerable students

Accelerated learning programmes	Flexible, age-appropriate programme, run in an accelerated timeframe, to provide access to education for disadvantaged, over-age, out-of-school children and youth. The goal is to provide learners with equivalent, certified competencies for basic education.
Catch-up and bridging classes	Short-term transitional education programme for children and youth who had been either attending school prior to an educational disruption – providing students with the opportunity to learn content missed because of the disruption and support their re-entry to the formal school system – or who require targeted preparation on a specific competence area, such as acquisition of a language (e.g. the level of instruction).
Remedial programmes	Targeted support concurrent with regular classes, for students who require short-term content or skill support to succeed in regular formal school. Most suitable for students who are behind expected grade-level competence.

Source: Adapted from Guide to the Accelerated Education Principles.[103]

Across the continent there is a large and growing number of flexible programmes that provide dedicated instruction time to vulnerable students both in and out of school. Most African countries surveyed in 2023 have initiated such programmes.[104] There is still a gap in the provision of some programme types, however, especially at scale. In the same survey, only seven countries reported that they have an accelerated learning programme at scale, while only half reported having scaled up remedial programmes (UNICEF, 2023).

The design of any of these programme categories can benefit from a growing body of literature, which has highlighted some cross-cutting pedagogical approaches with a proven track record in enhancing children's learning.[105] Tailoring instruction to a child's learning level, rather than solely to their age, is one such approach that has worked in non-formal and formal schools in low- and middle-income countries. Similarly effective has been supporting teachers with 'structured pedagogy' – a package that includes easy-to-follow scripted lessons with accompanying and levelled teaching and learning materials, guidance on conducting formative assessment, and continuous coaching from pedagogical supervisors, school leaders and peers. The use of national languages in the classroom to complement the official language of instruction are another example of potentially successful practice.[106]

Furthermore, these 'ingredients' of effective structured pedagogy appear to be more impactful when integrated rather than treated as isolated components.[107] This need for integrated strategies has major cost implications, however, especially when programmes aim to achieve a large scale. This calls for testing contextualized solutions that can be sustainably integrated within national systems and scaled. The Tusome national literacy programme in Kenya constitutes a prime example of an initiative that was successfully scaled up nationwide using evidence. This early grade programme

built upon subsequent rigorous studies to finetune its teacher training and coaching model as well as the distribution and development of teaching and learning materials, including student textbooks and teachers' guides.[108] Among the programme's achievements are 99 per cent of classrooms having a one to one ratio of books to students, and teachers having participated in four to five training sessions on early grade reading instruction.[109] In addition, the Ministry of Education, in collaboration with donors, researchers and implementers, carefully studied the journey from piloting to scale, ensuring the scalability of the intervention model in terms of financial resources, human capacity resources and accountability mechanisms.

The next sections present concrete examples of education programmes aimed at vulnerable children that navigated through these challenges, with a proven impact on their skill acquisition.

Accelerated learning programmes

For out-of-school children, accelerated learning programmes can provide an opportunity for children to gain foundational skills (including receiving a certification) and to (re-)enter the formal education system. Typically, children (aged 8–18 years) complete several years of education following a condensed curriculum targeting foundational skills. Accelerated learning programmes are commonly found in contexts with high rates of school exclusion due to poverty or prolonged crisis and conflict.

An additional feature of these learning pathways is the flexibility that allows participation even for children who are over-age (and sometimes no longer eligible for enrolment in primary schools), work or need to travel long distances to the learning centres. In Niger, Burkina Faso and Mali, the Strømme Foundation and Plan International tested an effective model, the Speed Schools. The Speed School programme condensed three years' worth of primary education in a nine-month intervention. Since 2004, it has provided access to over 150,000 out-of-school children (aged 8–12 years) in the Central Sahel.[110] Teaching occurs in community temporary spaces where locally recruited and trained facilitators deliver instruction to groups of 25 learners. The implementers, in conjunction with local formal schools, facilitate the enrolment of eligible learners usually in Grade 4. Children are taught to read and write in their local language during the first two months, and then continue with an accelerated curriculum in French. The average cost per Speed School enrolled child was US$132 in the Central Sahel[111] and US$85 for another seven-month accelerated programme in Nigeria, which yielded statistically significant learning gains in foundational skills.[112]

In Côte d'Ivoire, the Ministry of Education has spearheaded a three-year accelerated programme ("Classes passerelles") that allows successful participants to complete the primary cycle in three years, instead of the regular six. In the 2022/23 academic year, nearly 5,000 out-of-school children aged 9–14 years were enrolled in the programme nationwide, which offers the possibility to transfer to the standard primary grades or pursue technical and vocational training for older learners.[113,114]

In the short run, accelerated programme graduates largely transfer to the formal education system, but dropout reoccurs in the longer term. The transition rate from the "Classes passerelles" in Côte d'Ivoire to school has ranged between 76 per cent and 91 per cent between the 2013/14 and 2020/21 school years.[115] For Speed Schools in the Central Sahel, although 90 per cent of graduates transfer to formal primary schools, and despite making significant learning gains in French and mathematics, a varying share of Speed School graduates (for example, about a quarter in Mali)[116] end up dropping out again one year after reintegrating into the education system, due to demand- and supply-side

constraints.[117] More promising results in the longer term have been seen in Ethiopia, where a contextualized version of the Speed School model has been implemented since 2011.[118]

Catch-up and bridging classes

UNICEF Innocenti analysis of the Let Us Learn package of interventions in Madagascar found that catch-up classes years can effectively reintegrate lower secondary school dropouts.[119] The catch-up classes take place during the summer break for a typical duration of two months, targeting foundational literacy and numeracy skills for annual cohorts of approximately 10,000 children. The number of hours of instruction depends on the needs of the individual child, as determined through an assessment administered by teachers before the start of the course. Sessions are mostly conducted in small groups or through a mix of small-group and one-on-one tutoring in community-based facilities. To improve the quality of instruction, the catch-up programme supports the training of local supervisors and teachers, who are remunerated and receive pedagogical monitoring and support.

Remedial programmes

One of the most alarming signs of the current learning crisis is that even in-school children are failing to achieve grade-level competences. Evidence shows that failing to progress, including repeating a year, puts children at higher risk of dropout. According to a study on the drivers of primary school dropout in Mozambique, "school attendance, grade repetition and educational attainment are intermediate outcomes that, directly and indirectly, contribute to the dropout process".[120] It is therefore imperative to integrate effective pedagogical practices into the remedial education activities of regular schools, both to reinforce the foundational skills of low-achieving students and to reduce risk of dropout.

Tailored pedagogy models are an effective way for providing remedial education for students lagging behind in foundational literacy and numeracy. Strategies for teaching at the right level have been tested, adapted and scaled in various sub-Saharan African countries, including Ghana,[121] Kenya,[122] Côte d'Ivoire[123] and Botswana,[124] among others.

Providing remedial support to students who are falling behind is a distinguishing factor for 'positive deviant' schools – schools that outperform others operating under the same context – according to mixed-methods data collected as part of Data Must Speak research from multiple countries. In Madagascar, Togo and Zambia, positive deviant schools were more systematic in providing remedial support to struggling students, usually through additional lessons outside of school hours).[125,126,127] In Ghana, positive deviant schools tend to use remedial learning differently to the average school. Instead of focusing remedial support on students in their last year of junior high school, to prepare them for exams, positive deviant schools instead base remedial support on students' classroom or examination performance.[128]

What to consider when investing in programmes for the most vulnerable

Integrating social-emotional learning and mental health and psychosocial support

Acknowledging and promoting the emotional health and well-being of vulnerable students can enhance the impact of support programmes. Social-emotional learning and mental health and psychosocial support programmes have been found to contribute to a range of positive outcomes, including increasing academic achievement and attainment; improving attendance, engagement and motivation; benefiting the mental health of staff and students; and generally helping to improve their social and emotional skills.[129]

In Niger, for example, four hours of after-school remedial tutoring sessions per week, incorporating skill-targeted social-emotional learning, improved literacy and mathematics outcomes – even in the context of low attendance due to an unpredictable security situation, population mobility, seasonal migration and public school teacher strikes.[130] Importantly, in contexts of heightened threats to the well-being of the child, adding 'skill-targeted' social-emotional activities positively impacted school grades above and beyond access to tutoring alone. Meanwhile, in the Democratic Republic of the Congo, a curriculum focusing on mathematics and literacy skills while providing social-emotional support significantly improved children's learning outcomes and perception of school safety in conflict- and crisis-affected settings.[131,132]

Providing support for vulnerable girls

Girls are disadvantaged at all levels of education in crisis-affected countries.[133] Targeted support for vulnerable girls can be provided within or outside the formal school system. In Côte d'Ivoire, school-based clubs for mothers of female pupils were associated with higher retention of girls in school, without negatively impacting boys' progression.[134] Similarly, in Mali, these clubs were associated with higher overall promotion rates in secondary schools.[135] Meanwhile, afternoon blended learning classes, where digital learning was integrated into classroom teaching at a community-based centre for girls in Mauritania supported French language acquisition among adolescent girls whose low proficiency in French – one of two languages of instruction– put them at risk of dropout.[136] Learning gains were shared across all ages (11 to 16-years-old), with the largest gains among younger participants.[137] The use of personalized digital learning solutions that run offline, which is further explored in Section 3, contributed to achieving these outcomes.

In contexts where progress towards gender equity is still being made, providing equitable and targeted support for girls can be a challenge. In Burkina Faso, Mali and Niger, the Speed School programme was able to achieve near-gender parity in enrolment (slightly higher than girls' enrolment rate in formal primary schools across the three countries) by making concerted community engagement efforts.[138] In initial phases of the programme, implementers worked extensively with community and religious leaders to increase awareness on the importance of girls' education. This was also complemented with efforts to hire female instructors. Gender-responsive teaching and learning materials should also be used to support vulnerable girls, including by reviewing and minimizing gender stereotyping and exclusion.[139]

Harmonizing tailored programmes with mainstream structures

Harmonizing the relationship between tailored programmes and existing formal or mainstream systems, both within and outside of the education sector, is critical to their impact and sustainability. This involves several key areas including qualification mapping, supporting the education workforce, engaging communities and fostering cross-sector collaboration. Qualification frameworks and recognition of prior learning can ensure that alternative pathways are recognized within the broader system. For example, in Madagascar, the catch-up classes (CRAN) programme's end-of-course assessment determines the appropriate grade level for reintegration, and graduates received administrative support to reintegrate into formal lower secondary school.[140] Recent regional approaches have also proven effective. A formalized regional system of education attainment equivalency by the Economic Community of West African States has facilitated the inclusion of refugee learners in the national education systems in Burkina Faso, Ghana and Niger.[141]

Supporting the education workforce is crucial for effectively implementing and managing tailored learning programmes. This involves investing in training for teachers, school leaders and district education officials. Local supervisors and teachers receive specific training to improve the quality of instruction in Madagascar's CRAN programme.[142] Community engagement and cross-sector collaboration are also key components to expanding access to learning for vulnerable children. Meetings between heads of schools and parents of out-of-school children take place during the identification of CRAN participants; these meetings aim to raise awareness on children's right to education, parents' responsibilities and the programme's objectives/implementation.[143] In Liberia, collaborations between education, health and social services have enhanced alternative education programmes by addressing issues such as school feeding and health screenings.[144] Meanwhile, a strong coordination mechanism between the education and humanitarian sectors, including close collaboration between the Ministries of Education and of Emergency Management in Rwanda, has resulted in 94 per cent of school-aged refugee children being enrolled in primary schools.[145]

Embedding implementation research to tailor adaptations in delivery of programmes

The programmes discussed here demonstrate different approaches to supporting vulnerable students. Studies supporting their effectiveness have been carried out at small scale (on programmes led by non-governmental organizations), as well as on large-scale, government-led programmes. Governments need to consider the target population of vulnerable students and the types of barriers that they face, as well as programme design and implementation considerations (these will be delved into further in the third paper in this series[146]). A common lesson from the included examples, however, is the role of data and monitoring to assure and improve the quality of programmes.

For example, in Ghana, the Ministry of Education is implementing an enhanced remedial programme –Differentiated Learning Plus (DL+) – in more than 50 districts, which aims to boost foundational literacy and numeracy skills in primary Grades 2 to 6. The programme is delivered through a mix of formative assessments to tailor instruction to students' ability, improved teaching and learning materials, and community involvement around school activities. Alongside its implementation partners, including UNICEF, the Ministry has invested substantial efforts to embed research and learning into the roll-out of DL+, generating valuable evidence-based insights that are informing the scaling-up process to all districts. The programme's operational model is continuously adapted in response to the implementation research evidence collected. Cost-effective solutions to resolve

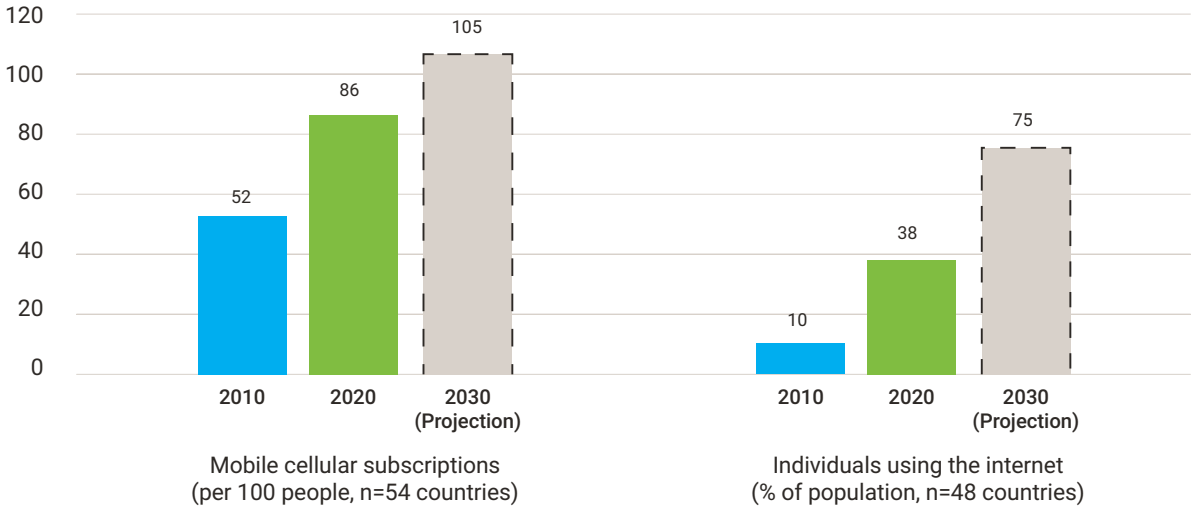
challenges at scale have included collaboratively developing effective teaching and learning materials at school level, leveraging existing resources from other interventions and printing low-cost materials to improve ratios of students to materials; using student-teachers and assistant-teachers to manage large ability groups amid teacher shortages and turnover; and relying on DL+ 'champions' among teachers and pedagogical supervisors to uphold effective teaching and supervising practices.

Education technology

The need to invest

Over the last decade, Africa has made rapid and substantial progress towards digital transformation. The mobile phone subscription rate has risen from 52 per cent in 2010 to 88 per cent in 2020, and over the same period, the proportion of internet users quadrupled (*see Figure 7*). This rapid growth is projected to continue. The Brookings Institution estimates that, by 2030, the continent could be at parity with the rest of the world, with three quarters of the population as internet users and universal mobile phone access.[147]

Figure 7: The rapid growth of digital connectivity in Africa is projected to continue (2010, 2020, 2030)



Source: World Development Indicators (2024) using data from International Telecommunication Union (for mobile cellular subscriptions and internet use) and United Nations Population Division and other agencies (for population data), Brookings Africa Growth Initiative (for 2030 projections). African Union member countries, rates weighted by country population.

The need for digital skills should not be considered a luxury. Children across the continent are preparing to enter a world that increasingly demands digital skills. A study by the International Finance Corporation (IFC) found that, by 2030, over 230 million jobs in sub-Saharan Africa will require digital skills.[148] Some level of digital skills will be required by 50–55 per cent of all jobs in Kenya, 35–45 per cent of all jobs in Côte d'Ivoire, Nigeria and Rwanda, and 20–25 per cent of jobs in Mozambique.[149] Digital fluency and information and communications technology (ICT) literacy skills will also be critically important for learners and workers in Tunisia and other countries across North Africa.[150,151] Most of the demand for digital skills will be from occupations outside ICT specialties and will instead be for foundational ICT skills, such as web research, online communication and online government or financial services.[152]

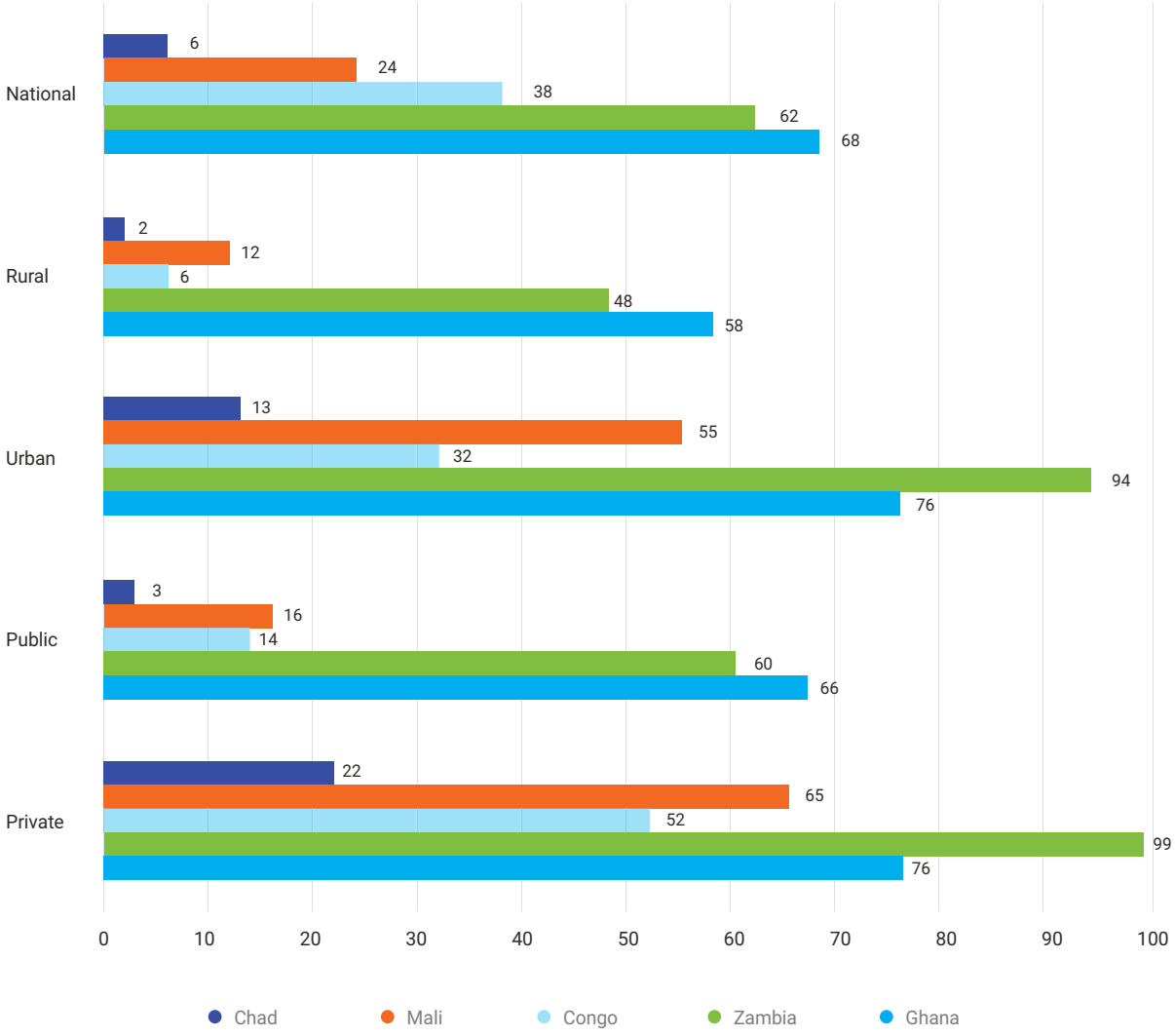
Furthermore, education technology goes beyond the acquisition of digital skills for employability and has been harnessed to build foundational literacy and numeracy skills during emergencies. Education technology, combining locally available devices such as radio and mobile phones, has expanded access to foundational learning opportunities for children and adolescents in crisis- and conflict-affected areas. It has been a means to maintain contact with families to keep their children engaged in learning activities, to deliver education content for self-directed study and facilitator-led classes, and to support teachers with training and guidance.

As a result, digital learning is high on the agenda for African governments. In a 2023 survey, 30 of 36 African countries reported that the government had taken concrete steps to advance digital learning (UNICEF, 2023).[153] Eighty per cent of national statements in support of SDG 4 by African countries contained commitments to support and improve digital learning in the education system.[154] However, there were fewer commitments to supporting the necessary preconditions. Only 59 per cent contained commitments to establish and sustain connectivity, and only 7 per cent contained commitments to introduce and update specific legal frameworks on learners' data protection, privacy, ownership, governance and vulnerabilities.

Access to digital infrastructure is uneven, with further gaps between access and use

Children and young people currently face several barriers that prevent them from accessing and using digital tools, with wide disparities across and within countries and regions. While 53 per cent of students in North Africa have access to a computer, for instance, this share drops to only 8 per cent in sub-Saharan Africa.[155] Only 14 per cent of students in sub-Saharan Africa access the internet from their home. Wide disparities exist between electrification rates in countries in sub-Saharan Africa ranging from 8 per cent in Chad to 96 per cent in Cabo Verde. Within-country access to electricity is also highly uneven and skewed in favour of households in urban areas, including in those countries where electrification rates are higher.[156,157] This uneven infrastructure also means that schools' access to the electricity needed to power digital learning is uneven. *Figure 8* shows rates of electricity access in schools by type of school and location in five sub-Saharan African countries.

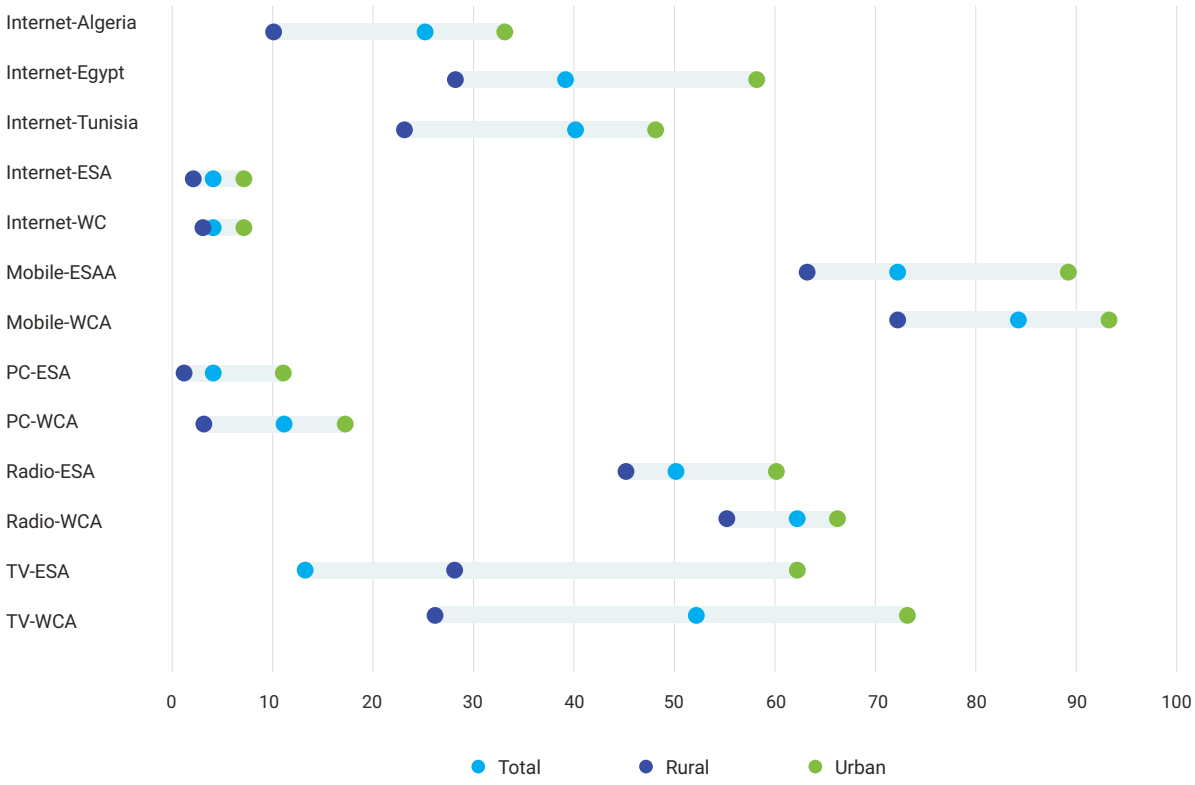
Figure 8: Students' access to electricity in schools (percentage)



Source: Data Must Speak and Teachers for All (Congo) Stage 1 reports based on EMIS data. Proportion of students enrolled in schools with access to electricity.

There are large disparities in device ownership rates between urban and rural areas. Mobile phones are the most accessible tool, even in rural areas (*see Figure 9*). TV and radio are relatively common in urban areas, but their ownership drops among rural households. Meanwhile, access to the internet and computer equipment remains limited even in urban areas.

Figure 9: Disparity of access to devices and the internet between rural and urban areas



Source: Reopening with Resilience series. Elaborated based on available DHS (Demographic and Health Surveys) and MICS (Multiple Indicator Cluster Surveys) data, 2010–2020, and World Development Indicators, World Bank (2022). ESA = Eastern and Southern Africa. WCA: West and Central Africa.

There is also a gap between access to technologies and their use. For example, the World Bank reported that 84 per cent of people in sub-Saharan Africa lived in areas where 3G service was available at the end of 2021. Yet, only 22 per cent were using mobile internet services.[158] Meanwhile, 61 per cent of people in sub-Saharan Africa were living within broadband range but not using it.[159] In short, the availability of connectivity or other infrastructure does not automatically translate into making the most of technology due to barriers such as data costs and limited digital literacy, among others. This is even more true in education technology. Even when using readily available technology, digital learning should be part of a well-defined plan for training and coaching facilitators on ways to embed that technology within their teaching practices, delivering interactive and personalized content that conforms with effective pedagogical principles.

What to invest in

To harness the potential of education technologies to strengthen system resilience and equity, African Union member States can invest in solutions that support both classroom integration and remote learning. It's important to recognize that education technology serves different purposes in these two contexts. In the classroom, education technology can enhance traditional teaching methods, provide interactive learning experiences and allow for more personalized instruction. When in-person attendance is not possible, education technology can be the primary means of delivering teaching and learning.

Low(er)-tech solutions for learning that households already have access to

To harness the potential of education technologies to strengthen system resilience and equity, African Union member States can rely on technologies that are already accessible to children and families. Often, the best technology is what is available, what people know how to use and what they can afford.[160] These solutions are particularly valuable for remote learning scenarios. However, they can also be integrated into classroom settings to reinforce learning and provide continuity between school and home environments.

A mapping of education technology solutions for children in conflict- and crisis-affected areas in the Central Sahel suggested that telephone tutoring offers promising prospects for educational continuity.[161] GEEAP ranked the use of mobile phones for learning as a promising approach confirming its potential, but also as a nascent field of practice that requires more evidence on how to adapt it in different context.[162] Emerging evidence supports its use, especially in mathematics, and it also serves as a tool to maintain contact with families, reducing risks of children's dropout. Basic mobile phones can be a practical tool for educational continuity in emergency settings for sharing pedagogical content with learners and delivering remote teacher training.[163] The availability of basic mobile phones is widespread even in crisis-affected regions. For instance, in Burkina Faso, access to basic mobile phones is around 78 per cent, including in crisis-affected areas, compared with only 23 per cent with access to smartphones.[164]

Radio is another low-tech solution that reached a critical mass of children, including those who have become displaced, through live broadcasts or the use of pre-recorded audio lessons.[165] In Rwanda, an experiment testing the impact of an educational animated cartoon programme on early learning found positive impacts on different domains for early learning, including counting, number recognition and vocabulary.[166]

One-way content delivery channels such as radio and TV have been combined with in-person activities and mobile phones to add interactivity and individualized follow-up support to students and their families. In Burkina Faso, Mali and Niger, locally recruited and trained facilitators leveraged radio courses during face-to-face listening clubs.[167] In Sierra Leone and Ghana, programmes used a mix of radio courses, individualized phone calls and printed student worksheets that were aligned to the radio content to introduce a two-way personalized follow-up with learners and their families.[168,169] Synergies between available technology and no-tech resources such as content-aligned printed sets should therefore be explored to enhance pedagogy, track learning progress and gaps, and maintain an open dialogue with a student's family.

On Call – a UNICEF Innocenti series on leveraging low-cost mobile phones for learning in emergencies – provides comprehensive guidance and practical examples for supporting continued education for the most marginalized.

Digital learning embedded into a learning process with a clear objective

Pedagogy remains inherently more important than the technology used to deliver content. A review of 81 studies on educational technology interventions in low- and middle-income countries concluded that simply providing technologies is not enough – just like it is not effective to solely provide inputs such as textbooks in isolation.[170]

Regardless of the specific delivery channels adopted, what is critical when designing and implementing any remote learning programmes is incorporating effective pedagogical practices and carefully planning for meaningful interaction with the end users and their families. In Botswana, for example, a phone tutoring programme incorporated teaching at the right level by tailoring mathematical problems sent via SMS (text message).[171] Where deployable, software that tailors content based on a learner's initial ability and progress is another avenue for personalizing learning pathways in line with effective practice. This was highlighted as a promising practice by GEEAP, provided that the technology is already available in learning centres or schools.[172] In Uganda, MobiLiteracy used basic mobile phones (for text and voice message) to deliver daily age-appropriate literacy activities and parental education activities to engage parents in rural areas in the learning process of their first-grade children.[173]

Technology must also be integrated into an operational plan at the school or learning centre level. Access to technology is only a first step to enable improvements to instruction and self-led learning to occur, which in turn leads to improved learning outcomes. Educational system planners can support the embedding of education technology through clear standards, guidelines and checklists for hardware management, scheduling, lesson planning and classroom management, among other areas.[174]

School-level planning for digital learning may have significant implications on end-user experiences and learning. An illustrative example of this comes from Guinea,[175] where two schools with the same digital devices and content had very different digital learning experiences owing to operational arrangements such as scheduling of classes and provision of in-class support to teachers. When making investments, governments must ensure that technology is met with proper planning for implementation and guidance for schools. If the technology being introduced is not useful for teachers and able to be integrated into their processes, it will likely not work. Research across multiple countries has shown that it takes time, practice and hands-on training for teachers to learn and integrate a new tool into their day-to-day teaching.

What to consider when investing

Investing in offline digital learning solutions for those who need it now

Digital learning solutions that are sensitive to gaps in infrastructure, device availability and internet connectivity are expanding. They include portable and low-cost Wi-Fi boxes that offer offline access to pre-loaded content from user devices such as mobile phones or tablets; and digital learning applications that can be utilized offline from a user device.[176] For digital learning to be equitable and accessible for all, having 'offline' functionalities is a must.[177] The use of a digital learning application in this manner, for example, produced language learning gains among vulnerable girls in Mauritania (see Box 1). There is still considerable work to be done for education technology designers and programme managers to enable this degree of access to their products. In UNICEF's review of 40 digital personalized learning products used in low- and middle-income countries, only 16 offer some form of offline access and only

3 are accessible via feature phones.[178] (Feature phones are aimed at customers who want a medium-range phone that is not overly priced and also offers some features of a smartphone. A feature phone has more functions than a basic phone but fewer features than a smartphone.)

While logistically challenging, digital learning can reach those not yet reached by the electrical grid and be a gamechanger in providing learning opportunities for those children on the move, in conflict or otherwise unable to travel to a formal school. In Sudan, e-learning centres managed by communities in remote areas use solar panels to power devices and provide learning to out-of-school children. Many of these centres have remained in operation during the conflict and humanitarian crisis which began in 2023, demonstrating how digital learning can provide learning resilience in times of need.

Box 2: Enabling offline digital learning in Mauritania and Guinea

Implementation research of the use of blended learning in the Akelius programme in Mauritania identified several key features of the programme that this success can be attributed to, including: the use of offline capability to reduce logistical hurdles and data costs, and the provision of hands-on training, pedagogical support, and on-site technical and operational support for teachers.[179]

- **Offline capability:** A secure private network feature allowed the use of a single 'host' tablet, typically used by the teacher, to update and transfer content to other tablets (about 15 per class) within the network. This means that only one tablet needs to be taken to an area with connectivity. It also reduces data costs, as downloading of the content from the internet needed to happen on just one device.

- **Teacher engagement, training and support:** Teachers were engaged as co-designers during the early stages of the programme, providing feedback which was incorporated to contextualize the application. They also received multiple rounds of hands-on training, coupled with ongoing pedagogical supervision in the classroom. The training focused on the content of the app as well as how to embed it in a lesson plan. On-site focal points for troubleshooting technical issues and managing devices also reduced the burden on teachers.

The importance of supports to embed digital technology with teachers' and schools' practices was also illustrated in a case study from Guinea, where the Ministry of Education has included adoption of the Learning Passport platform among its Priority Projects.[180] Two primary schools, located within 20 minutes of each other, with similar class sizes and in receipt of the same number of tablets with pre-downloaded content, was found to use them in very different ways.[181] In one classroom, tablets were barely visible, with six students sharing a tablet, while in the other classroom there were only two – sometimes three – students per tablet. Class scheduling explains some of the difference – the first classroom had two class groups scheduled to use the tablets simultaneously. Teacher feedback and school monitoring also highlighted that some tablets were underutilized due to operational challenges relating to charging and transferring tablets to and from the charging station.

Creating digital content and using AI for more inclusive education

The UNICEF 'Pulse Check' report[182] on digital learning found just 17 out of 53 countries in Africa with official digital learning platforms had interactive content; the remainder had static content such as PDFs or slides, limiting their usefulness as a tool for teaching and learning. The potential of digital learning lies in its ability to deliver engaging, interactive and personalized learning experiences. Engaging and interactive experiences could come from gamified content to interactive activities and tests that provide instant feedback to determine understanding and learning progress. Digital education content can support accessibility of children with different types of disabilities through functionalities such as sign language translation, colour contrast, text to speech, captions and adjustable font sizes. Such adjustments can also support students with a range of learning and vision challenges, as well as language learners. Governments in Rwanda, Kenya and Uganda are part of the Accessible Digital Textbooks (ADT) initiative, creating curriculum-aligned digital learning content with accessibility features so that children with and without disabilities can engage with the same content, in the same classroom. Artificial intelligence (AI), including generative AI, will enable a content revolution that will make production, translation and accessibility cheaper and faster. It is imperative that governments in Africa investigate ways to leverage AI for these benefits of the technology, while also safeguarding against potential harms in its use in education.

Embedding research into digital learning programmes

Finally, measuring the impact of technology on learning starts from the beginning of a programme. At UNICEF, research conducted on the impact of education technology programmes has been possible due to strong partnerships from the onset of programme planning, with research embedded within the roll-out of the programme.[183] Monitoring is critical and it requires more than looking at data from the platform. Combining data from schools, classes, and feedback from teachers and students, along with data generated by digital learning platforms, allows programme implementers to gain a full picture. As illustrated in the Guinea example in Box 2, embedded implementation research allowed programme managers to detect challenges and help schools correct them along the way.[184]

A key takeaway from this section is that, whether to support classroom-based instruction or remote learning, education technology should be considered a tool to complement, not replace, quality teaching. The effectiveness of education technology at scale in Africa relies on how well it is integrated into pedagogy, and the support provided to teachers and students in its use. Investments in digital learning must also be balanced with low- and no-tech solutions, and monitored closely, to ensure equitable access and avoid exacerbating existing inequalities.

Implications for education policy

An underlying implication from the research summarized in this paper is that **strengthening education system resilience and strengthening overall system efficiency are not competing goals**. Investing to expand quality ECE, provide targeted education programmes for vulnerable students, and thoughtfully integrating education technology into teaching and learning can contribute to both objectives:

- **Expanding access to ECE** has been found to improve outcomes for children, families and the education system, as well as increasing resilience by alleviating the negative impact of learning disruptions. To expand ECE access effectively and equitably, governments and partners should consider:
  - leveraging existing infrastructure, such as primary school buildings and community facilities, where feasible;
  - designing and implementing clear quality standards and monitoring mechanisms that can be adapted and used across diverse programme approaches and providers;
  - investing in context-appropriate learning materials that support holistic child development accompanied by teacher training and support;
  - designing parent and community engagement components that are responsive to their different levels of literacy and resourcing levels.
- **Supporting the most vulnerable students** through remedial, bridging, catch-up and accelerated programmes has been found to reduce repetition and dropout rates. These interventions can also provide learning continuity and reintegrate out-of-school children and youth back into the education system following disruptions. Effective approaches include:
  - implementing targeted instruction methods, such as teaching at the right level;
  - providing flexible learning pathways that accommodate the needs of over-age learners and working children;
  - integrating social-emotional learning and mental health support into academic programmes;
  - ensuring gender-responsive approaches in programme design and implementation.
- **Integrating education technology in teaching and learning** has been found to enhance learning experiences and support system resilience. As the impact of technology is dependent on context and implementation, policymakers should consider a nuanced approach that:
  - prioritizes pedagogical goals over technology, ensuring that digital tools complement rather than replace quality teaching;

- invests in low-tech and no-tech remote solutions alongside digital technologies to ensure equitable access, particularly in areas with limited infrastructure;
- focuses on offline capabilities and locally relevant content to overcome connectivity challenges;
- provides comprehensive training and ongoing support for teachers in effectively integrating technology into their teaching practices;
- carefully monitors and evaluates the impact of technology interventions to inform iterative improvements and scaling decisions.

To maximize the impact of investments in these areas, policymakers should consider the following overarching principles:

- **Work with existing systems and resources:** Innovative solutions should leverage what already exists in the education system. They include expanding successful community-led early childhood and tailored education approaches, as well as widely available technologies such as basic mobile phones and radio while countries continue to build digital infrastructure.
- **Prioritize equity:** Explicitly equity-focused efforts are crucial to prevent the widening of existing disparities in access to and quality of education. They include targeted education programmes for vulnerable students combined with mainstreamed early childhood education, differentiated pedagogy and personalized education technology programmes for supporting children with a wide range of abilities and backgrounds.
- **Embed research and monitoring:** Continuous data collection and analysis should be integrated into programme design and implementation to allow for ongoing quality improvement and evidence-based decision-making. This approach enables policymakers and programme leaders to identify what works, what doesn't and why, in different contexts. This topic will be discussed further in the next paper in this series.
- **Promote flexibility and adaptability:** Education systems should be prepared to provide learning continuity during crises and disruptions, including through pivoting between in-person, remote and blended learning approaches. This includes the ability to adapt teaching methods, content delivery and resource allocation in response to changing circumstances as well as using emerging evidence from monitoring data and external research. Adaptability is key to building overall system resilience.

By focusing investments on these areas of latent potential and adhering to these principles, African education systems can make significant strides in improving efficiency, equity and resilience. However, it is crucial to recognize that context matters, and strategies should be tailored to the specific needs and resources of each country and community.

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