

Connected Education

How digital technologies can transform
education in sub-Saharan Africa

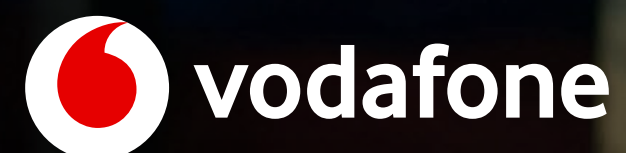




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Foreword

by Shameel Joosub,
CEO of Vodacom Group

Nelson Mandela described education as our most powerful weapon to change the world. He also said, “A good head and good heart are always a formidable combination. But when you add to that a literate tongue or pen, then you have something very special.”

It is unfortunate that for many children and young people across Africa, quality education remains out of reach. While access to education has expanded since the 1960s, a closer look at the numbers reveals that increasing access to education doesn't necessarily equate to an improvement in its quality.

In fact, at present, there are worrying signs that education in Africa is stagnating, and, in some cases, even regressing.

As such, access to education may have improved across Africa, but educational outcomes have not. And these circumstances were only been exacerbated by the pandemic. Recent research suggests that Covid-19 caused the region's learning poverty rate (the inability to read and understand a simple text by age 10) to reach a staggering 89%. This was already a concern in 2015 when 'Access to Inclusive and Equitable Quality Education' became a Sustainable Development Goal (SDG 4) as part of the UN's 2030 Agenda for Sustainable Development.

However, setting bold objectives is only the first step. We need to action them to achieve these goals.

As the UNESCO Institute of Statistics states, even if some countries meet their benchmarks, the world will not succeed in achieving access to inclusive and equitable quality education by 2030.

While this is a sobering reality, it must not deter our efforts. Rather, it should serve as an impetus to improve how we set about taking steps in the right direction and accelerating progress.

So, how do we guarantee that the future generation in Africa is not left behind? There is no doubt that the barriers are substantial, which means that finding success is not a simple task. A multifaceted approach, which understands and considers the economic, social, and political environment, must be adopted. We must use the resources we already have to their fullest. There is no denying that technology has opened up a new world of possibilities in almost every aspect of our lives, and education is no exception. While the pandemic did result in setbacks, it showcased how digital tools and technologies – in combination with reliable connectivity – can provide entirely new platforms for education.

In addition, it highlighted that technology can play a key role in addressing many of the barriers to education that exist in Africa by transforming how learning and teaching are conducted.

We've seen this in action through our ecosystem of education projects and initiatives, all of which are designed to provide access to quality educational resources, support remote learning and enhance the overall educational experience for learners, especially in some of Africa's most rural and under-resourced communities. This includes Vodacom e-School, which provides access to digital learning materials, educational resources and support services for learners from Grades R to 12 in South Africa, for free. Another great example is Safaricom's partnership with Zeraki, an interactive digital learning platform in Kenya, that not only provides learning material for teachers and learners but also includes a school management system so that teachers can better track the administrative side of education.



Written by
Shameel Joosub
CEO of Vodacom Group



In another initiative, the Vodafone Foundation's Instant Network Schools, which was established in 2013, has enabled more than 224 000 refugee learners to access digital education in hosted communities at 84 schools across Kenya, Tanzania, the Democratic Republic of Congo, South Sudan, Mozambique and Egypt.

If we are to expand the scale and impact of digital education, we have to ensure universal and reliable access to electricity, improve teacher training in ICT, address gender discrimination and language barriers and make sure that technical support is more readily available. Most critical of all, is to close the digital divide.

According to the International Telecommunication Union (ITU), only 39.7% of the population in Africa use the internet, which is significantly lower than the global average of 66.3%. Given that the extreme poverty rate in Africa stands at around 50% across rural populations and 10% in urban areas, many of the tools needed for digital education are simply unaffordable. In addition, these economic realities make it difficult for schools to invest in the equipment needed to deliver digital education.

Resolving the challenges of connectivity and affordability demands that we develop strategic alliances between governments, the private sector, universities, development agencies and technology companies.

Each can bring a unique perspective and different sets of resources to the table, which, when combined, Africa's digital literacy agenda. Through these partnerships, we can establish the foundations – from regulatory frameworks and the necessary teacher training to investments in digital infrastructure – to build inclusive digital education systems.

The goal must be for all learners and teachers regardless of who they are, where they are and what they can afford, to be able to access quality education and, ultimately, participate in the global digital economy.

Executive Summary

The proliferation of digital devices and mobile network expansion in sub-Saharan Africa should make digital education more readily available to teachers and students in Africa. This is especially true where data and devices are more affordable and easily accessible. However, equitable access to quality education on the continent remains elusive. While the Covid-19 pandemic hastened the need for a renewed focus on digital transformation in education, and necessitated strategic alliances between governments, businesses, universities, development agencies, technology companies and venture capital firms, many learners and educators throughout Africa are at risk of being left behind.

This paper, the fifth in our six-part Africa.connected series unpacks the current state of education across the continent and showcases how digital technologies and connectivity, combined with the necessary regulatory frameworks and support from governments and industry stakeholders, can be leveraged to mitigate barriers to education across the continent.

The paper begins by highlighting the hurdles to successful digital education in Africa. While there has been progress in improving access to education, this does not mean that the quality of the education being offered has increased. Today, around 97.5 million African children – from primary school age to secondary school age – do not attend school. This number is higher than in any other region in the world. The learning poverty rate (the inability to read and understand a simple text by age 10) for sub-Saharan Africa is 86% and completion rates show that the longer African children stay in school, the higher the probability that they will drop out.



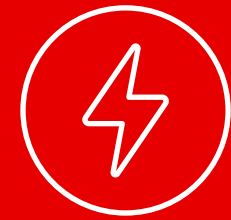
The paper goes on to make a case for the importance of connectivity and digital technologies in enhancing the quality of education offered across Africa. Digital education can transform the classroom environment by providing teachers with new instructional tools and enabling them to better track learner progress. Digital education can also help to overcome various barriers to education – from geographically remote locations to disruptive events like pandemics, civil unrest or natural disasters. Digital education can be instrumental in bridging inequalities in access to knowledge, particularly for young girls who are often physically unable to attend school.

Digital education has the power to transform the lives of students by expanding their vision of what is possible and connecting them to learning resources when there are no qualified teachers in their immediate physical environment.

To tap into this potential, Africa must prioritise digital skills and digital literacy. These are critical factors in reaping the full benefits of digital education, and are now considered a foundational pillar for the growth of African economies.

There are many barriers to digital education. They include:

Electricity



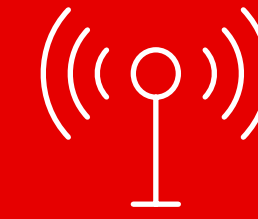
According to World Bank data from 2021, less than 50% of the population in sub-Saharan Africa has access to electricity. In rural areas, the average is only 28.5%. From the perspective of education, many individuals, schools and communities are unable to power computers, internet routers and other digital devices, making it nearly impossible to use them for education.

Qualified teachers



Many African countries face a shortage of trained and qualified teachers capable of effectively using digital resources and technology in the classroom. This is particularly the case in rural areas where access to education is limited.

Access to technology



Economic conditions in Africa mean that it can be difficult to access digital education tools. Many schools on the continent still do not have equipment like computers, tablets, and smartphones, or online resources and applications for students to access digital learning material. This means students and teachers cannot use digital technology for their learning and teaching experiences.

Internet access



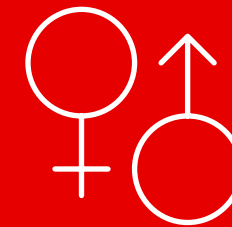
One of the main infrastructure challenges in Africa is the lack of reliable and affordable internet connectivity. The lack of internet access limits the ability of students and teachers to use online educational resources, communicate with peers and participate in digital learning activities.

Political instability



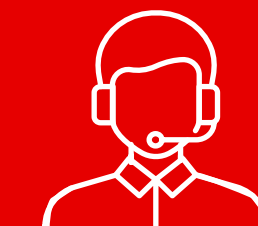
In 2021, 11 African countries were included in a list of 21 countries whose governments deliberately shut down the internet access of their citizens. Although the intention is generally to quell civil unrest, educational institutions are particularly hard hit by such shutdowns; this was particularly concerning during the pandemic when academic activities moved online.

Gender barriers



Gender inequality can have a significant impact on the already poor implementation of digital education in Africa. One of the consequences of gender inequality is related to the relative lack of access to technology for women. According to the United Nations Development Programme (UNDP), women and girls in Africa are less likely to have access to technology and digital resources and are also more likely to face barriers to participating in the digital economy. This makes it more difficult for them to access and benefit from digital education.

Technical support



Many schools in Africa do not have the support staff needed to help teachers and students with technical issues related to digital resources and technology. This makes it tough for teachers and students to access and use digital resources and technology effectively.

Language barriers



An estimated 1 000 to 2 000 languages are spoken on the continent. Understandably, language barriers can significantly impede access to digital education resources in Africa. Many digital educational materials and platforms are only available in languages spoken by a small proportion of the population, such as English and French, while most people in Africa speak indigenous languages.

These issues are significant. But strategic interventions and innovative mindsets can do a lot to lessen their impact on digital literacy.

The paper highlights different startups and initiatives that have done just that – leveraging solar power to address unreliable electricity, embracing satellites, wireless mesh networks and community networks to boost internet access, zero-rating digital learning platforms to make learning content available on mobile devices, including recycling mobile phones to help those limited by affordability constraints. These are just a few of the interventions that are already boosting digital education success across the continent.

The paper outlines a model to improve the impact of digital education and offers recommendations on what a possible national government strategy for digital transformation in African education could look like. This includes creating a positive regulatory ordinance that supports digital education and building strategic partnerships with the ability to provide optimal coverage for digital education. There is also the suggestion that governments commit to continuous training in digital technologies to build a sufficient base of human capital that supports and sustains digital education and invest in digital infrastructure through planned and consistent funding.

Finally, the paper highlights the importance of cultivating a digital mindset in the education user community, increasing access to digital education through greater affordability and demonstrating digital leadership throughout the education and training system.



Further to this, digital transformation strategy recommendations are:

1. Embed digital transformation across government.
2. Reallocate national budgets for digital transformation.
3. Enable, connect, and expand small-scale, localised digital education projects.
4. Transform teacher education to meet the demands of digital teaching.
5. Prioritise digital inclusion in education.
6. Establish a policy and planning platform for digital education.
7. Exercise political will with respect to the digitalisation agenda in education.

Chapter 1. The crisis in African education

Since the 1960s, there has been a significant increase in access to education across Africa. By 2010, 68% of African children completed primary school and 40% lower secondary school. The number of students in higher education also increased rapidly, as did literacy rates among adults. Today, more than 80% of African children are enrolled in primary education (Roser and Ortiz-Ospina, 2023). However, according to Roser et al. (2023), 57% of the world's primary school-age children who are not in school live in sub-Saharan Africa.

However, the increase in the number of children attending school has not been matched by improvements in the quality of African education. On almost every indicator of progress, there are disturbing signs not only of stagnation in African education, but even of regression.

Addressing the education crisis in Africa requires focus on three areas; ensuring children are attending school, supporting them to finish their education, and then making sure that they are competent in education basics, like literacy and numeracy.

Out-of-school rates



The share of African youths not attending school in Africa ranged from 17% in 2019 in primary school (compared to 43% in 2000) and 53% in upper secondary school (compared to 63% in 2000). Out-of-school children in general (primary, lower secondary, secondary age) counted at a staggering 97.5 million for Sub-Saharan Africa, more than any other region in the world.

Completion rates



The completion rates (completing a cycle of schooling e.g., primary education) declined to 65% in primary school, 41% in lower secondary and only 23% in upper secondary school. In short, the longer children stay at school, the more likely they are to drop out for various reasons. Importantly, there is a great variation in primary school completion rates for different regions of the continent, with North Africa at 83% completion but West Africa only at 53% overall.

Learning poverty rates



Learning poverty is defined as the inability of children to read and understand a simple text by age 10. For Sub-Saharan Africa, the learning poverty rate was a remarkable 86% compared to approximately 13% in Europe and Central Asia and less than 60% for Latin America and the Caribbean.

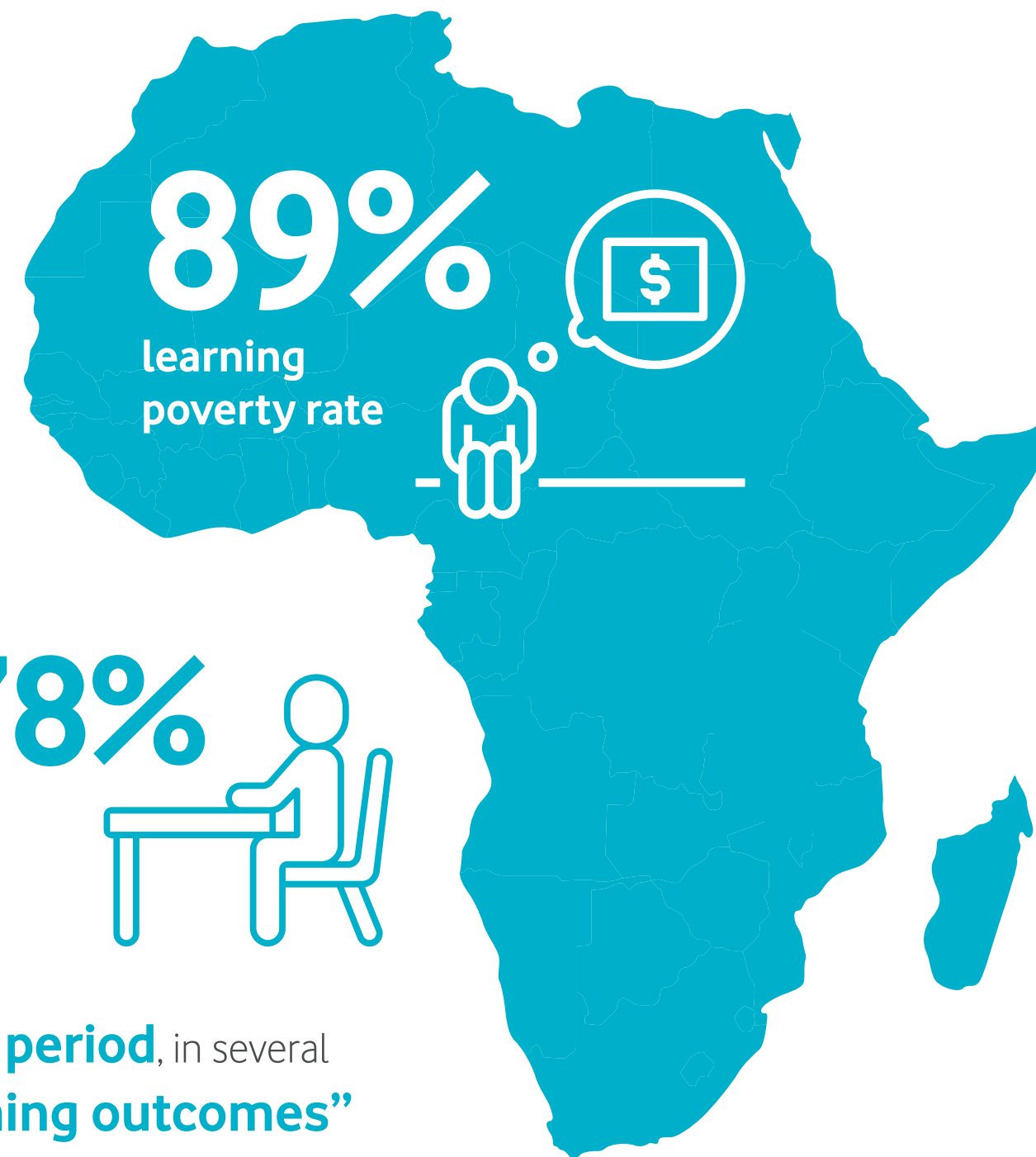


Ref: (UNICEF, 2021; Rogers, 2022).

Effects of the pandemic: Learning poverty

To make matters worse, already vulnerable school systems across Africa were further hindered by the global pandemic that, in the period up to January 2021, resulted in an average of 23 weeks of partial and complete closures of schools throughout Africa (Reimers 2022, p.8). These closures caused massive losses in learning time, which, in turn, resulted in the decline of learning outcomes:

One simulation forecast that the **learning poverty rate in Africa rose to 89% (Rogers, 2022) after Covid-19**, impeding the progress of learning outcomes in African education.



Another projection shows that the rate of improvement is so slow on the continent that, **by 2030, around 78% of African children will still experience learning poverty** (UNICEF, 2021).

A third study revealed that over a **10-year period**, in several African countries, the **“change in learning outcomes”** caused declining academic achievement.

In many instances, Covid-19 restricted learners’ ability access to learning resources when they were **forced to learn from home** because they did not have the tools needed to do so successfully (Evans and Mendez Acosta, 2021).



Can target setting work?

There has been no shortage of multilateral initiatives that seek to radically improve access to and the quality of global and African education over the past decades – from Education for All (Reimers, 1990) to Agenda 21 (Mullin, 1992), to the Millennium Development Goals (UN, 2000) and the African Union Agenda 2063 (African Union, 2013). In 2015, however, the General Assembly of the United Nations adopted the 2030 Agenda for Sustainable Development, which consists of 17 Sustainable Development Goals (SDGs) and include SDG 4, which is about education.



SDG 4 (UNESCO, 2022) aims to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.” SDG 4 sets out seven targets to be achieved by 2030. These are shown in the image below.



Sustainable Development Goal 4: Education



Increase the number of youth and adults with relevant skills for work



Eliminate gender and other disparities in access to education



Ensure that youth and adults achieve literacy and numeracy



Access to technical, vocational, and tertiary education



Access to free education



Access to quality pre-school education



Ensure that all learners acquire knowledge and skills for sustainable development



Increase the supply of qualified teachers



Expand the number of scholarships available to developing countries



Build and upgrade educational facilities

The key question, of course, is whether African countries are on track to achieve these outcomes?

The UNESCO Institute of Statistics, responsible for monitoring progress against countries' own benchmark values, has stated that "even if countries achieve their benchmarks, the world will not achieve SDG 4." (UNESCO, 2022).

1 in 5 incompetent in reading and maths

1 in 5 not in school

1 in 4 do not complete school

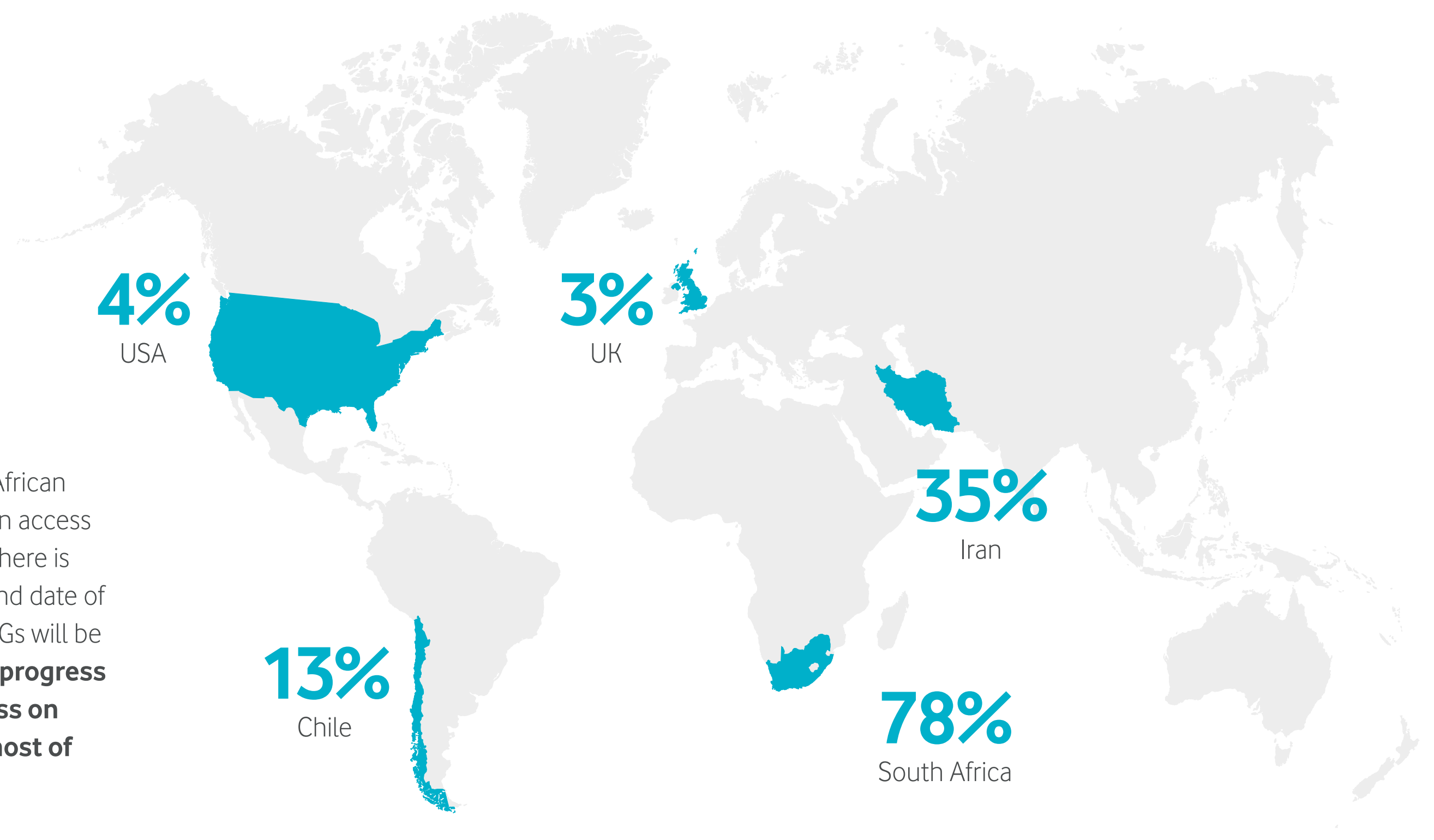
Global Education Monitoring Report of UNESCO (Global Education Monitoring Report 2020)

This means that even though countries have committed to the SDGs, **there will still be 84 million (5%) young people out of school worldwide by 2030** (UNESCO, 2022).

These are averages for the whole African continent. Of course, as these singular examples demonstrate, there are great regional variations. In South Africa, for example, the Progress in International Reading Literacy Study (PIRLS) showed that **78% of Grade 4 children** cannot read a text for meaning – the worst of the participating countries. This statistic forms a stark contrast to **35% in Iran, 13% in Chile, 4% in the USA, and 3% in the UK**. The number of out-of-school children, in fact, increased by 0.9 million in Central Africa, while it remained stagnant in Eastern and Southern Africa.

The global goals set by multilateral agencies could spur action among African governments to renew their focus on access and quality in education. However, there is little evidence to suggest that the end date of 2030 for the achievement of the SDGs will be met. **Current data suggests slow progress on some indicators, little progress on others and even regression on most of the SDG targets.**

So, what is to be done?

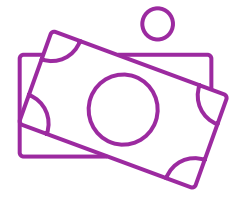




Chapter 2. The case for digital education

The pandemic served as a disruptor that forced the government and school authorities to pay attention to the power and potential of digital education technologies in education.

Beyond this, what is the argument for digital education in Africa?



1. Digital education is a cost-effective way to improve a country's performance on the SDGs in lieu of expansive and expensive physical infrastructure (Van Manen et al., 2021). The features available on mobile phones can act as a catalyst for SDG4; more than 1.4 billion subscribers in Africa use their mobile phones for the educational benefit of their children (Chebib, 2020).



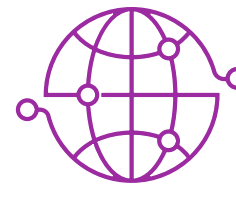
2. Digital education offered via mobile devices can effectively leapfrog the traditional fixed-line technologies that commonly represent the initial transition from face-to-face teaching to online learning. Digital education can significantly transform the classroom environment by providing teachers with instructional tools and providing students with greater learning flexibility.



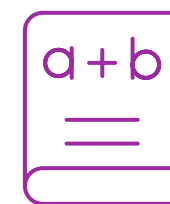
3. Digital education can play a role in overcoming the inequalities in access to knowledge in divided societies, with shared learning platforms readily available in real-time to those who would otherwise not have been able to access them.



4. Digital education is a norm-breaking intervention in restrictive societies. By offering education from a distance where it is difficult, if not prohibited, for some to physically attend school, digital education has potential to boost education diversity. Globally, more than 129 million girls do not attend school because of poverty, gender-based violence and child marriage (Van Manen et al., 2021). In addition, girls miss up to 50 days of schooling each year due to the lack of sanitary wear (Life Healthcare, 2021) and digital education gives these young girls the opportunity to study at home.



5. Digital education can be leveraged to mitigate barriers to education – from geographical remoteness to disruptive emergencies (like pandemics, civil unrest and/or dramatic weather events) so that children can continue to learn wherever they are (Digital UNICEF, 2020).



6. Digital education can provide scalable solutions to the twin problems of access and quality in African education, given “the virtually infinite scalability of digital learning platforms”.

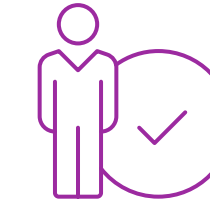


7. Digital education has significant spin-off effects, like lower carbon footprints, for example, which in turn contributes to the achievement of SDG 13 (lowering the impact of climate change).

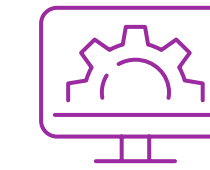
Here are **12 vital arguments** for digital education and digitalisation in a post-Covid world



8. Digital education enables personalised monitoring so that teachers can monitor a learner's individual progress and customise the learning journey so that it is at the right level for that student. This is important because there is no one-size-fits-all.



9. The need for digital education is widespread. Digital content is becoming more affordable; digital skills are now considered a foundational pillar for the growth of African economies (World Bank, 2020).



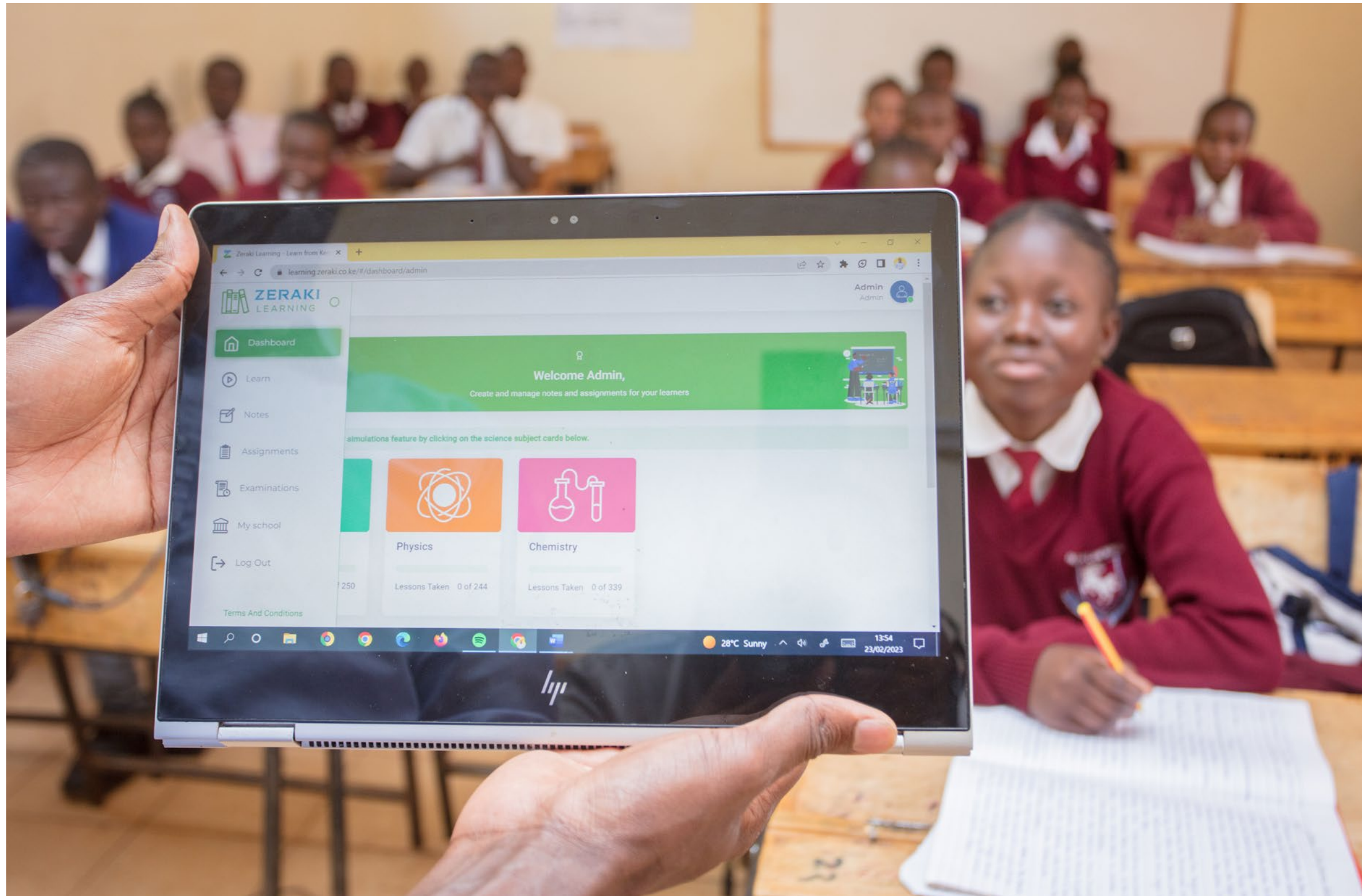
10. Digital literacy is crucial to exploit the full benefits of the digital economy, such as how to efficiently access and utilise online services and resources.



11. Digital education can transform the lives of students by expanding their vision of what is possible through, for example, technology-related careers.



12. Digital options offer students access to subject matter experts online in the absence of qualified teachers in their immediate physical environment.



People who are connected can access shared learning platforms in real-time, bridging knowledge imbalances in divisive communities. Digital education is particularly useful in situations where it is difficult, if not impossible, to attend school in person. In traditional communities, it is an intervention that defies convention. Formerly hindered by poverty, gender-based violence and child marriage (UNICEF), digital education now offers more opportunities. Digital education can significantly change the learning environment in the classroom with the help of instructional technologies and more flexible learning options for students and teachers. Students get access to subject matter experts online when there are no certified teachers available close by. Because no one-size-fits-all approach to learning exists, digital education enables individualised tracking of the learning process by continuously monitoring each learner’s unique progress and tailoring their educational experience to their comfort level.

Instant Network Schools – providing a different view on education in Africa

About a decade ago, Daisy Jardim was struck by lightning. While the experience was, understandably, traumatic, it served as a catalyst for her future and inspired her to study electrical engineering. It was around the same time that the Vodafone Foundation, in partnership with the United Nations High Commissioner for Refugees (UNHCR), launched Instant Network Schools. The programme seeks to bring digital education to refugee communities; providing young refugees, host communities and their teachers with Internet connectivity and enabling them to access digital learning material. With over 80 Instant Network Schools currently operating across six countries: Kenya, Tanzania, the Democratic Republic of Congo, South Sudan, Mozambique and Egypt, the programme aims to ensure that refugees, and children from the communities that host them, have access to accredited and relevant learning opportunities. Today, Daisy is a Vodacom Mozambique employee and is an Instant Network Schools volunteer. She uses her technical knowhow and skills to help these communities use technology to transform learning. She works closely with the teachers at these schools, helping them set up different digital resources and providing guidance around how to effectively use these tools and technologies in the classroom. As many of these refugees and their hosts have not had much exposure to new technologies, their responses have been varied. Some of the teachers reacted very well and were able to use the equipment. Others needed more help getting the basics right and we had to show them how to teach the students using technology, she notes.

But it was the students’ reaction that made Daisy realise the importance of the work they are doing. “When we give a tablet to a child in a bigger city, they will browse for games or search for their favourite football players on Google. But in these schools, the first thing the children do when they are given a tablet is do their homework or look for information related to what they are learning at school,” she says.

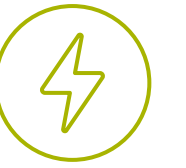
Speaking about her time as volunteer, she describes her work in these communities as “the best thing ever.” Because of these experiences, Daisy believes that technology can transform our understanding of what education is and it should inform what education can be. “This work gives me the opportunity to work with people of so many different backgrounds and cultures. I have learned so much from them and love that I get to share my knowledge with others in return.”

Chapter 3. Barriers to digital access in African education

Access to digital technologies and the internet has become an increasingly important determinant of education success in the 21st century. Although there is great variation, many African countries experience significant barriers to digital access in education. Some of these include unreliable and non-existent electricity supply, limited access to the technologies and technical support needed for digital education, as well as gender norms, language constraints and restrictive responses to civil unrest. We unpack these in more detail here.



Electricity



Perhaps the most debilitating barrier to digital access on the African continent is a lack of electrification. According to the World Bank, less than half of the population in sub-Saharan Africa have access to electricity. In rural areas, the average goes down to just 28.5%. When individuals, schools and communities cannot power their computers, routers and other digital devices, it is impossible to use these tools for education. There is evidence from Zambia and South Africa (where rolling blackouts are called loadshedding), that interrupted electricity supply has negative effects on education; disrupting teaching, hampering opportunities to learn, limiting testing and even affecting the safe transport of students in the early hours (Bwalya Umar et al., 2022).

Ensuring universal and reliable access to electricity is fundamental for Africa's digital revolution.

Access to electricity drives access to mobile connectivity and can be a significant driver of digital inclusion in sub-Saharan Africa. Electrification must be accelerated to ensure that all people, including students, can enjoy the benefits of technology.

But rather than only seeing this lack of electricity as a barrier, we can see it as an opportunity to harness modern technologies in the African educational context.

While developed nations struggle to transition to more sustainable, renewable energy, Africa can essentially leapfrog the rest of the world by bypassing traditional centralised power distribution systems in favour of more decentralised, renewable energy generation infrastructure. This is a particularly attractive option considering the vastness of the continent and low levels of infrastructure and electrification, especially in rural areas.

Internet access



One of the main infrastructure challenges in Africa is the lack of reliable and affordable internet connectivity. According to the International Telecommunication Union (ITU), only 39.7% of the population in Africa uses the internet. This is significantly lower than the global average of 66.3%. A lack of internet access prevents students and teachers from using online educational resources, communicating with their peers and taking part in digital learning activities (ITU, 2022). The following table summarises some key indicators related to internet access in Africa.

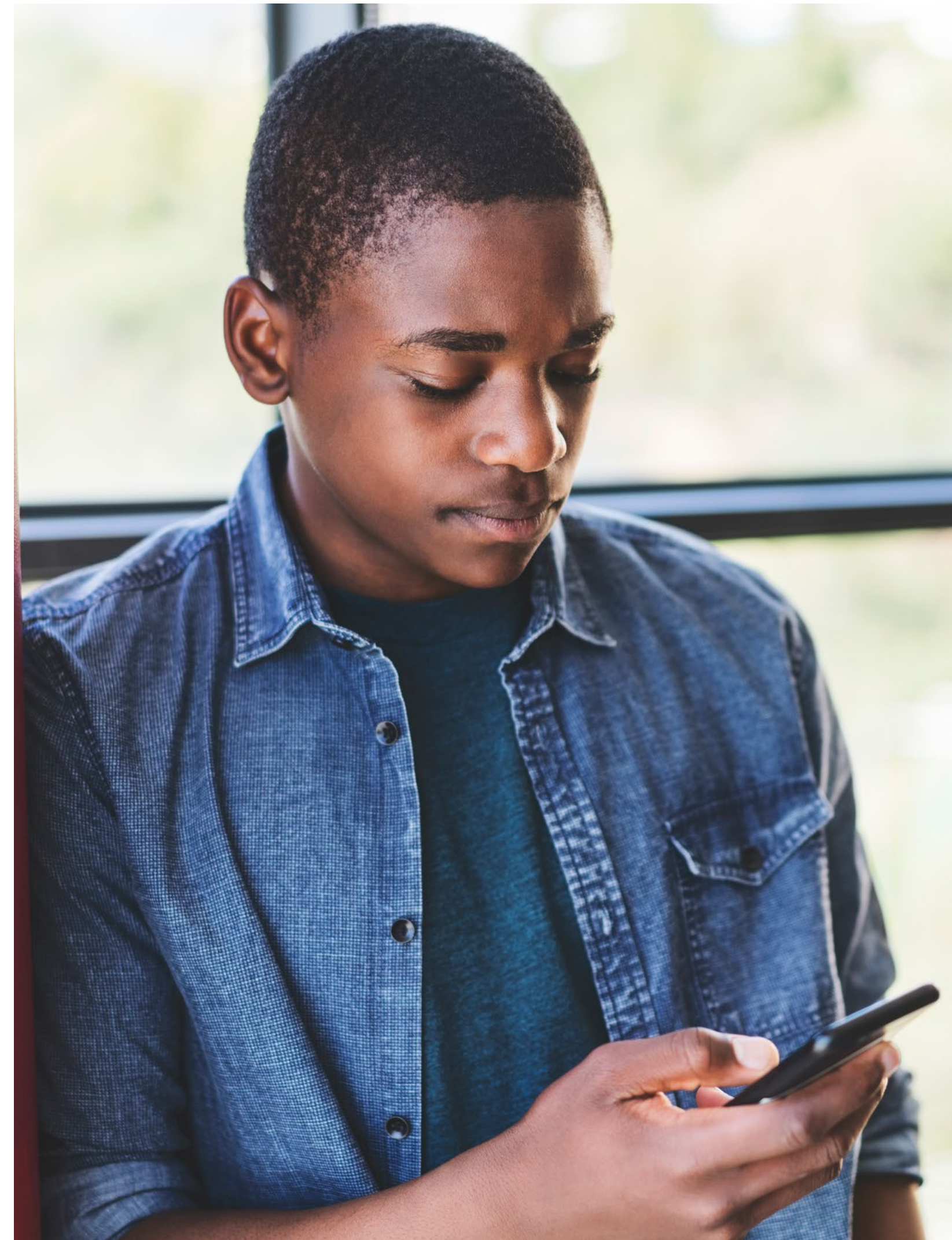
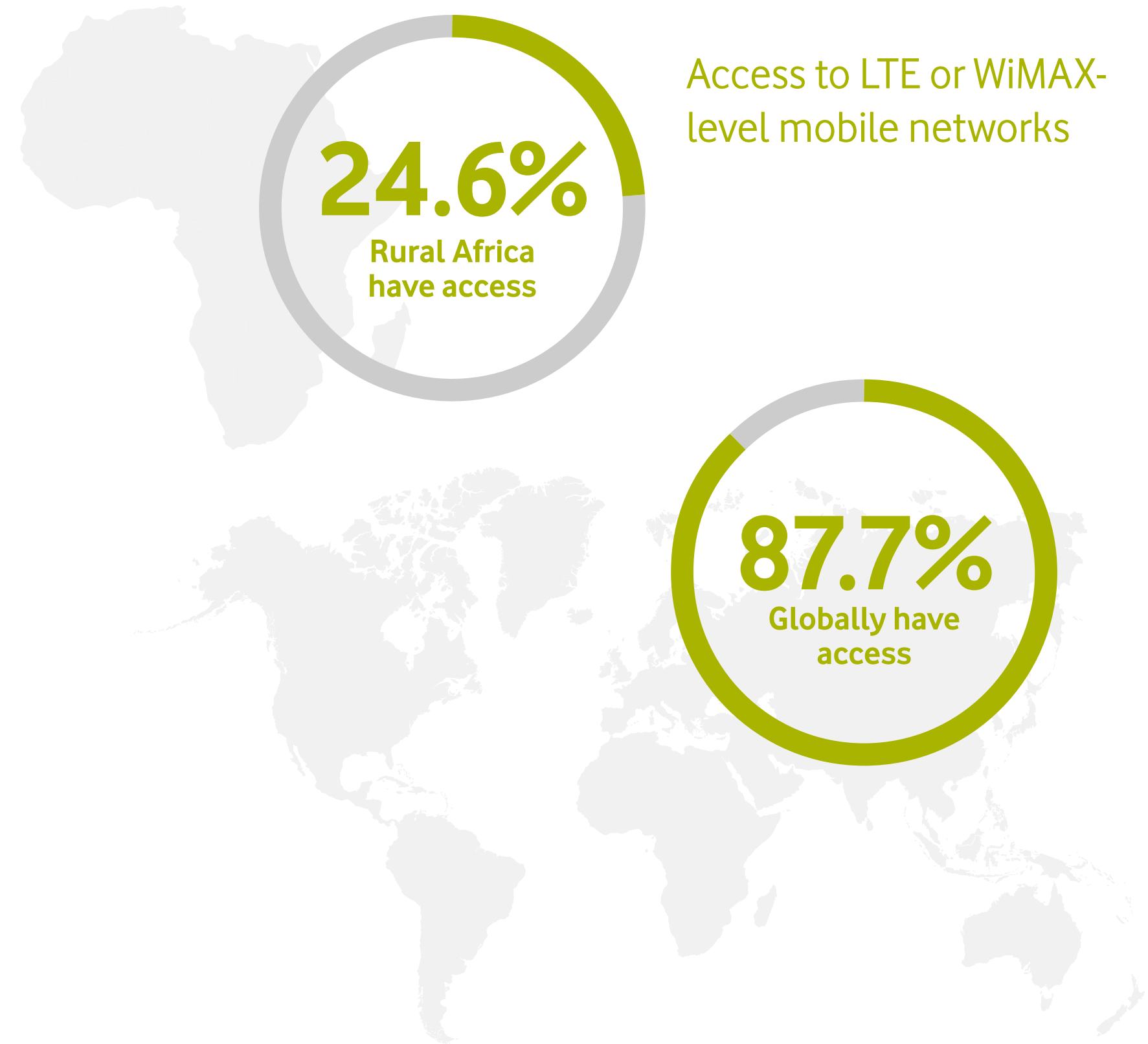


Table 1: Comparison of 2022 ITU indicators for urban and rural Africa and the world

	Africa			World
	Urban	Rural	All	
Households with internet access at home (2020)	--	--	22.7%	65.7%
Population covered by:				
• mobile-cellular network	100%	85.3%	91.5%	97.3%
• at least a 3G mobile network	98.0%	71.1%	82.4%	94.8%
• at least an LTE/WiMAX mobile network	97.1%	24.6%	49.6%	87.7%
Individuals (aged 10+) owning a mobile phone	--	--	60.6%	72.7%
Individuals using the internet	63.5%	22.7%	39.7%	66.3%
• Youth (15-24)	--	--	55.3%	74.8%
• Rest of the population	--	--	35.9%	64.8%

(Source: ITU Statistics 2022).

Africa trails behind the rest of the world in terms of internet connectivity. Although mobile cellular network coverage is improving, access to fixed broadband internet remains a problem. While the numbers for urban areas in Africa compare favourably with global averages, figures from rural areas paint a vastly different picture. For example, only 24.6% of the population in rural Africa has access to at least LTE or WiMAX-level mobile networks, compared to 87.7% globally.



The affordability of internet data, especially mobile broadband products, also puts internet access out of reach of many. The United Nations Broadband Commission for Sustainable Development defines affordable broadband access as the availability of broadband access at a price that is less than 2% of gross national income (GNI) per capita. Mobile data prices as a percentage of gross national income per capita in Africa remain the highest in the world. In 2022, data-only mobile broadband basket prices as a percentage of GNI per capita in Africa stood at 5%, compared to 2.4% in the Americas and 0.4% in Europe. Furthermore, fixed broadband basket prices as a percentage of GNI per capita in Africa were 15.6% on average, compared to 3.8% in the Americas and 1.1% in Europe (Broadband Commission, 2022).

This means that internet access in Africa is not universally available or affordable, particularly for people living in rural communities. Vodacom and Vodafone are working on this issue as part of the ITU/ UNESCO Broadband Commission for Sustainable Development. As a starting point, last year, the Broadband Commission ratified the first multi-stakeholder study aimed at creating practical tools and actions around increasing internet access around the world.

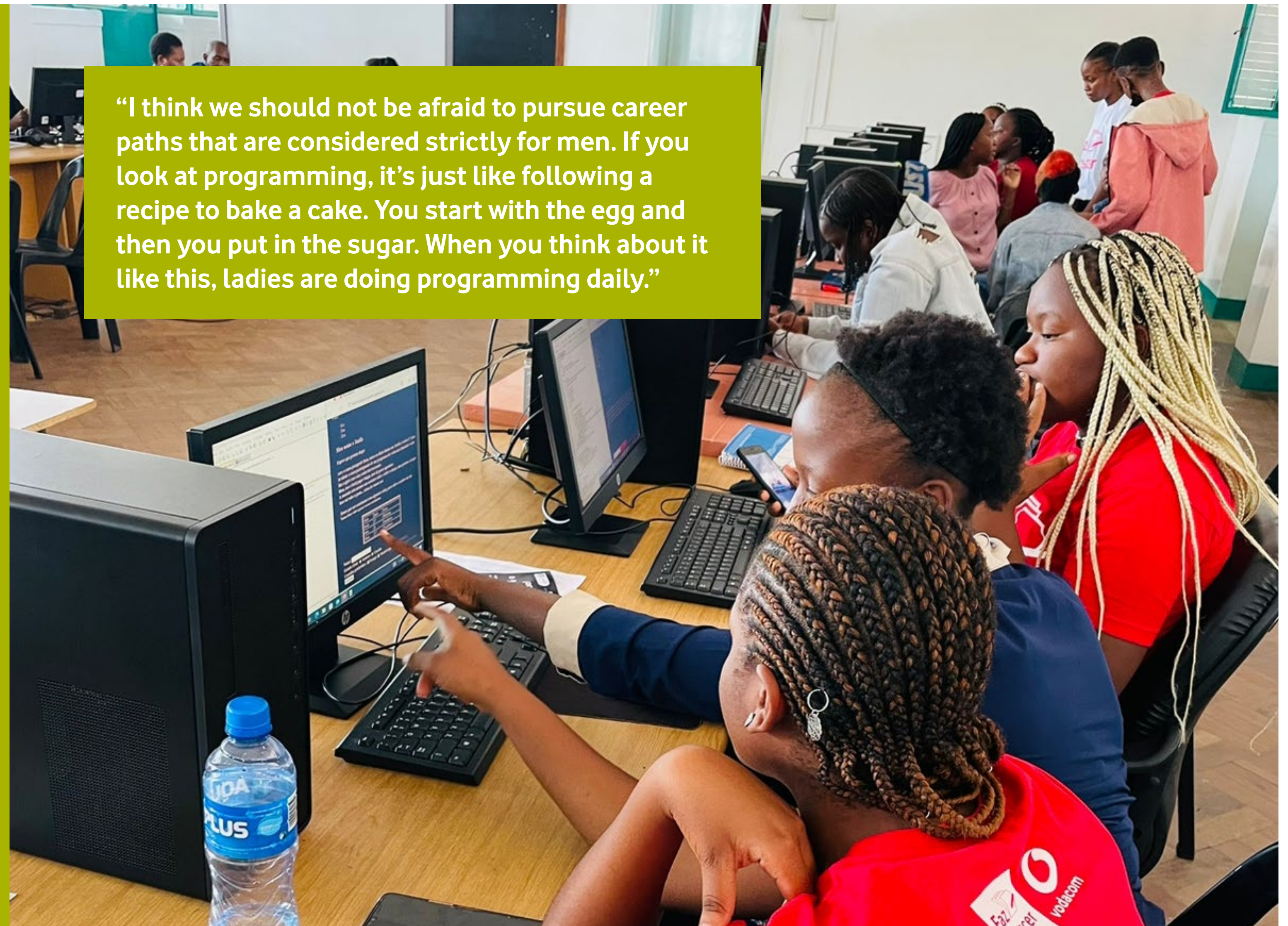
Changing the Mozambican tech industry one girl at a time

Otilia Cossa and Loice Timana are Code Like a Girl advocates. These young Mozambican women both embody everything that the programme hopes to achieve. The programme aims to address the low representation of girls in science, technology, economic and mathematics [STEM] fields and to get more girls to pursue careers that demand coding skills. Participants are taught introductory web development skills such as HTML, CSS and Javascript and are challenged to design and develop a website. The idea is to show young women what they can do and to rouse an interest in pursuing a career in IT and technology-related fields.

For Otilia the coding bug really bit at university and today she is completing her bachelor's degree in computer applications online. Getting the people in her life to accept and understand her career choice was not easy. Her parents for one did not understand that she was working while sitting in front of her computer and not watching movies or playing games. Similarly, when Loice decided to study technology and information systems at university, some members of her family questioned her decision. They worried that the course would be too difficult for her to follow. She believes that there are not a lot of Mozambican women in STEM fields because young women are actively discouraged from pursuing careers in tech. "They are taught to shy away from and be afraid of doing things that aren't traditionally what women are 'supposed' to do." Loice didn't let this perception stop her and, instead, is championing this conviction to other young women as a Code Like a Girl trainer.

Loice describes herself as a cheerleader who wants to look out for others and show girls in technology that they can be an asset to the industry.

"I think we should not be afraid to pursue career paths that are considered strictly for men. If you look at programming, it's just like following a recipe to bake a cake. You start with the egg and then you put in the sugar. When you think about it like this, ladies are doing programming daily."





Proof of what young women can do, the pair want to be role models for others and hope to highlight what careers in tech really look like. “When I tell young girls about my experience, they are like: ‘Wow, I also want to be like her,’” says Otilia. However, there is still so much work to be done.

According to Otilia, the number of girls involved in tech is still exceptionally low. “At the meetups I attend, about 90% of the people are men”, she notes. And many of the young people living in rural Mozambique don't have access to computers and can't afford data. “For these girls, they can only learn when they are physically present for the course. When it's time to go home, they can't experiment or practice what they've learned because they don't have computers or reliable internet access.” This however, is changing. In its first year, the Code Like a Girl programme only had 15 girls. In the second year, the team got close to 100 and, despite some setbacks due to the Covid-19 pandemic, the 2022 programme reached 300 girls. “We have interviews on the first day of training and most of the girls say that they want to do medicine or become a professor or a teacher”, explains Loice. “But by Friday, they tell us that they love what they've learned and are keen to go into IT or engineering. They change their mindset because they can see how much they have learned in one week and no longer question what they can and can't do. We are shifting people's mindsets slowly,” she says. “But change is happening.”

Access to technology



Most Africans cannot afford the tools needed for digital education. According to the World Bank, while the poverty rate in Sub-Saharan Africa continues to fall, the number of poor people increased by 18 million between 2015 and 2018. As such, it is unsurprising that expensive devices, like computers or smartphones, are often out of the question. Without intervention, the digital divide in Africa will only continue to widen (World Bank, 2020).

Many African schools also lack the equipment necessary for digital education. And even when devices are available, they are either outdated, in poor condition or too expensive to use.

Qualified teachers



African education is also constrained by a lack of qualified teachers. Many African countries face a shortage of trained and qualified teachers capable of effectively using digital resources and technologies in the classroom. This is particularly the case in rural areas where access to education is limited.

UNESCO's Global Education Monitoring Report says the average pupil-teacher ratio in primary schools in sub-Saharan Africa is 37:1, which is significantly higher than the global average of 20:1. This lack of digitally-savvy teachers makes it difficult for students to get the most out of the digital resources and technologies in the classroom. It also limits opportunities for professional development (UNESCO, 2021).

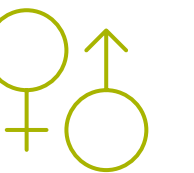


Technical support capacity



Another human resource constraint is a lack of technical support staff. Many schools in Africa do not have the support staff needed to help teachers and students with technical issues related to digital resources and technology. This can make it difficult for teachers and students to access and use digital resources and technology effectively. According to a study by the International Telecommunications Union (ITU), only 35% of schools in sub-Saharan Africa have access to technical support (ITU, 2022).

Gender barriers



Women and girls in Africa are less likely to have access to technology and digital resources, according to the United Nations Development Programme (UNDP). The International Telecommunication Union (ITU) says only 34% of women had internet access, compared to 45% of men, in 2022. As such, it is often more difficult for girls to access and benefit from digital education (UNDP, 2023). They may lack the skills needed to effectively use technology and, thus, will not be able to fully participate in the digital economy (World Bank, 2020; World Economic Forum, 2020).



Language barriers



An estimated 1 000 to 2 000 languages are spoken in Africa, and of these, over 75 are spoken by more than one million people (ITU, 2022). This diversity must be considered when creating interventions in digital education.

Language barriers can understandably impede the effectiveness of digital education resources in Africa. Many digital educational materials and platforms are only available in languages spoken by a small proportion of the population, such as English and French. In **fact, the WEF estimates that 80% of online learning content is available in just 10 languages.** This prevents many students from fully participating in online learning and properly understanding the materials presented (Van Manen et al., 2021).

Addressing the language barrier in digital education is a complex and ongoing process and there is still a long way to go to ensure that all Africans have equal access to digital education, regardless of the language they speak.

Political instability and security



A new but equally significant challenge has emerged in government's response to civil unrest relating to digital access. In 2021, 11 African countries were included in a list of 21 countries where governments deliberately shut down the internet so that their citizens could not access it. Although their aim is to quell civil unrest, this approach has an incredibly negative impact on digital education.

An estimated **171 million internet users across Africa were affected by such shutdowns during 2021**, leading to a total economic loss of \$1.93 billion. It must also be acknowledged that the safety and security of education technology equipment can be a significant barrier to digital education outcomes. If children cannot safely take devices home and continue with the digital learning experience after school hours, they may struggle to feel the full impact of digital learning.

Chapter 4. Scaling up

With the right policies, infrastructure and investments, digitalisation can provide new opportunities for businesses, governments and citizens in Africa to lay the foundation for a more equitable, sustainable and connected future. But Africa's unique challenges call for alternative technologies to make digital education more readily available, especially in underdeveloped rural areas.

While several technologies are currently available, the challenge is to scale these interventions, and digitalisation in general, to have a more meaningful system-wide impact. Given the substantial barriers to digital access in education, this is not a simple task. A multifaceted approach, which understands and considers the economic, social and political environment, must be adopted.

Some options to address the challenges highlighted early in this report and improve digital education across Africa are unpacked below.



Embracing alternative sources of energy

The Sustainable Africa Scenario (SAS) estimates that 90 million people need to be connected to electricity every year to attain universal access to reasonably priced power by 2030 (SDG7). Currently, 43% of the world's population, or 600 million people, lack access to electricity and most of them live in sub-Saharan Africa.

Ghana, Kenya and Rwanda, are on schedule to have complete access by 2030 and provide success stories that other nations can emulate.

While expanding the national grid is the least expensive and most sensible choice, in some scenarios, in rural areas, where more than 80% of people live without access to electricity, mini-grids and standalone systems, which are typically solar-powered, offer a welcome alternative (IEA, 2022).

The DigiTruck project was launched in 2019 to promote digital inclusion in remote and rural Kenyan communities. The initiative was launched through a partnership between the Safaricom, Kenya's Ministry of ICT, Computer for Schools Kenya, GSMA and the Belgium NGO Close the Gap, with Huawei providing the vehicle (Close the Gap Digitruck Programme, nd.).

"This was the first time I was taught how to use a computer and it's had a real impact on me. Now things are much easier and I'm planning to set up my own business using technology."

Carolyn, a DigiTruck student



Converted from a used shipping container, the DigiTruck is a mobile classroom that provides digital skills training for people and communities most in need. It accommodates 20 workstations and is equipped with computers, tablets, smartphones and an internet connection via Fixed Wireless Access. The truck is fully solar powered, which means that it can even add value in communities without power supply.

Since the rollout, over 2,300 students have received more than 80,000 hours of training in 19 counties in Kenya. Each 40-hour course covers basic digital literacy skills, including how to use smartphones, the internet, email and office software. It also provides guidance around the management of electronic waste, as well as a range of essential soft skills, such as drafting business documents, searching for jobs online and starting an online business.



Prioritising affordable internet access


Identifying the best solutions to provide affordable internet access in rural areas depends on the specific context and needs of each community. For example, Vodacom has launched eSchool and ConnectU platforms for people who cannot afford the internet. It is available for free to Vodacom customers and the offer includes making 1,000 websites available to learners at no extra charge.

There are several alternatives to traditional broadband internet that could prove effective in countries throughout Africa.

Satellite technology

Using satellites to beam internet connections to remote places that are hard to reach by traditional terrestrial networks can be a cost-effective approach, particularly in countries where traditional infrastructure is lacking. In 2020, Vodafone and AST SpaceMobile unveiled their plans of creating a space-based mobile network.

The Democratic Republic of the Congo (DRC), Ghana, Mozambique, Kenya and Tanzania are among the 49 major equatorial nations whose mobile network coverage is expected to change significantly from 2023. This space-based mobile network will immediately connect the devices of **1.6 million people to 4G and 5G** without the use of specialised hardware (Vodafone, nd.).

 **1.6 million people connected**

Another example: LEO satellites orbit closer to Earth's surface than traditional satellites and can provide low-latency, high-speed internet services to rural areas.

The costs of launching and maintaining these satellites has fallen in recent years, making this an increasingly viable option for providing affordable internet access. SpaceX's Starlink project is launching a constellation of LEO satellites to provide high-speed, low latency internet access to the unconnected.

 **1,000 satellites launched**

Vodafone and AST SpaceMobile have already launched more than 1 000 satellites and are currently providing beta services to customers in the United States, Canada and the United Kingdom.

Wireless mesh networks


Wireless mesh networks use a network of nodes to transmit data from one place to another.



These networks can be set up quickly and cheaply, making them a good option for rural areas where traditional infrastructure is lacking. The Meraka Institute in South Africa has deployed mesh networks in several rural areas in South Africa and has demonstrated the viability of this technology to provide affordable internet access to remote communities.

TV white space technology

TV white space technology takes advantage of unused frequencies in the television spectrum to provide wireless internet access. It is a viable connectivity alternative because it requires less infrastructure than traditional cellular networks.

 **50 Kenyan schools and colleges connected**

The Kwese Free Sports trial in Kenya demonstrated the feasibility of using TV white spaces to provide affordable internet access to rural communities. During the trial, more than 50 Kenyan schools and colleges were connected to the internet.

Community networks

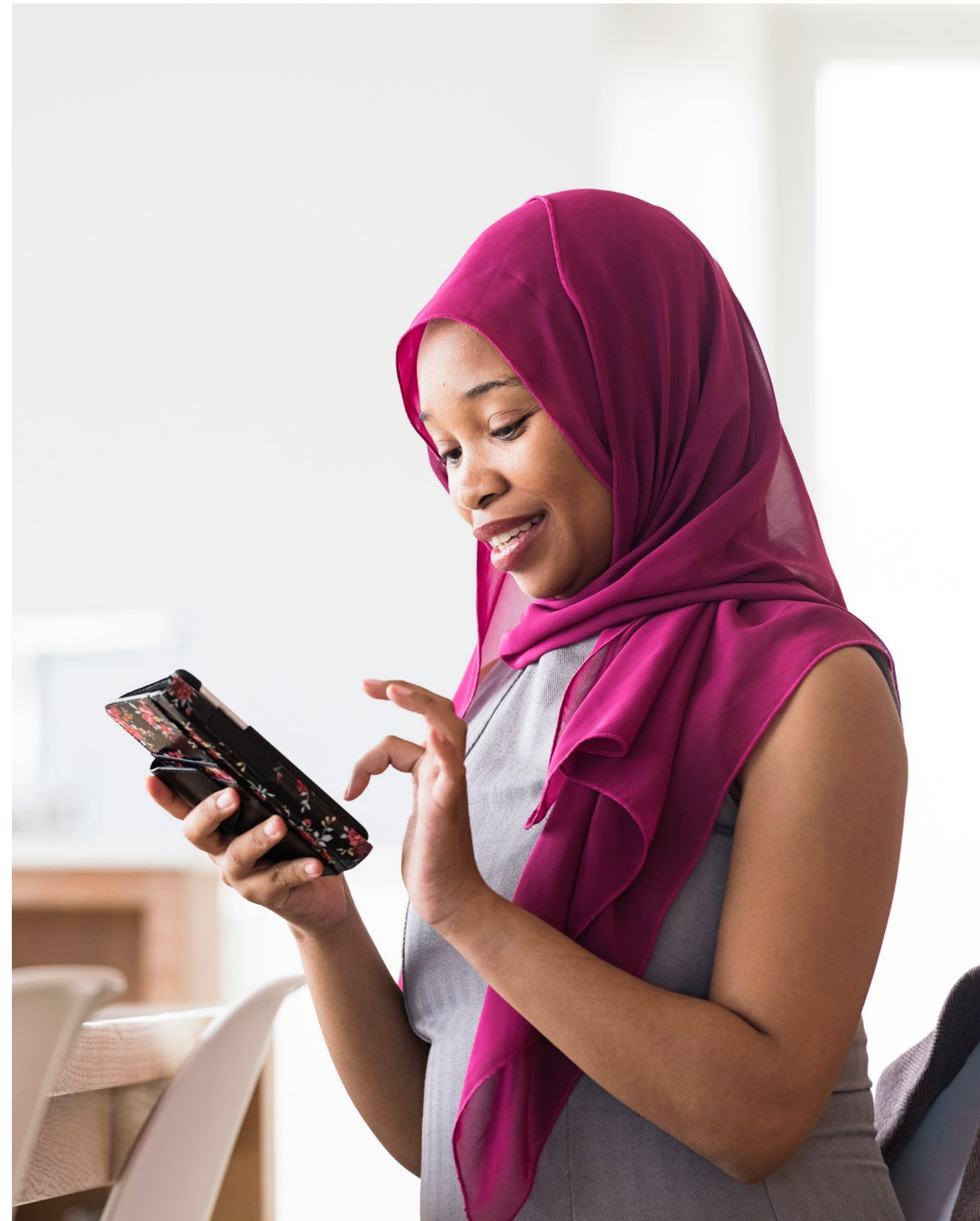
Community networks are owned and operated by local communities. These networks can provide affordable internet access to rural areas by leveraging low-cost technologies and existing infrastructure. The Community Network initiative in South Africa's Western Cape province provides affordable internet access through the development of community-owned and operated wireless networks. It has successfully provided internet access to several rural communities in the Western Cape. The initiative helped to bridge the digital divide in the region, by enabling learners to access high-quality and effective educational resources.



Siyavula is a South African digital education platform that offers open-source, online textbooks and resources for mathematics, science and technology subjects. Siyavula covers a wide range of subjects, from basic arithmetic to advanced topics in physics, chemistry, and biology. Siyavula's resources are available for free, making them accessible to students regardless of their financial situation.

Alternative methods to boost access to technology

In resource-constrained environments, a circular economy can help increase access to technology. When resources are kept in use for as long as possible, and waste is minimised by designing products and services that can be easily repaired, reused, refurbished or recycled, rather than being thrown away after a single use, more people stand to benefit from each item.



There are several key benefits of a circular economy when it comes to digital access:



Cost effectiveness:

By reusing and refurbishing existing digital devices, schools and students in Africa can access technology at a lower cost than if they buy new devices.



Quality:

Refurbished digital devices can often be of comparable quality to new devices, as they have been tested and repaired to ensure they are in good working condition.

Support for local economies:

By refurbishing and repairing digital devices locally, a circular economy can create jobs and support local economies in Africa.

Reduction of electronic waste:

By keeping digital devices in use for longer, the amount of electronic waste generated is reduced, reducing the environmental impact of technology production and disposal.



Increased access:

A circular economy can help increase access to digital devices for education in Africa, making it possible for more students to have access to technology and digital resources.

Recycling mobile devices is another strategy that can be used to improve access to digital devices for education in Africa.

In many African countries, mobile phones are the primary means of accessing the internet and provide a cost-effective solution for students who lack access to computers. Mobile phones and tablets have several advantages compared to used computer equipment, like portability, affordability and lower energy use. These factors make them better suited to the needs of many in Africa.

By collecting and refurbishing used mobile devices, we can connect students who cannot afford to purchase new devices, while also reducing e-waste and promoting sustainability.



MobileMunster in Australia

collects and recycles mobile phones, with a strong focus on educating the community on repair, reuse and recycling. A portion of its profits are used to support digital education initiatives in developing countries, including Africa.



Mobile for Education

is associated with the United Nations Development Programme (UNDP), and collects and refurbishes used mobile phones for schools in partnership with several African countries. It also provides training and support to teachers and students.

Creating educational ecosystems

Vodacom's ecosystem is designed to provide access to quality educational resources, support remote learning and enhance the overall educational experience for students, especially in rural areas.

Educational institutions, governments and non-profit organisations also use the ecosystem to support their education initiatives and programmes. The target audience for Vodacom's ecosystem for education is anyone who wants to improve their education and access learning resources, as well as organisations and institutions working to improve education in Africa.

It is a suite of products and services, provided by Vodacom, including digital learning platforms, connectivity solutions and educational content for schools and students aiming to support and improve the education sector in Africa.

"The Vodafone Foundation Instant Classroom enables tablet-based teaching for 7-to-20-year-olds attending schools in refugee camps. It is being deployed in Kenya, Tanzania, and the DRC since 2015. Mobile and digital changes everything. Our Instant Schools For Africa programme will put a wide range of advanced learning materials - tailored for each local language and culture – into classrooms everywhere, from city slums to remote villages. We believe Instant Schools For Africa could transform the life chances for very large numbers of young people."

Andrew Dunnet, Vodafone Foundation Director.



The six pillars as described below, underpin the schools of excellence model (Vodafone, 2020):



Pillar 1

Early Childhood Development (ECD) Centres.

Of the 15 ECD centres that the Vodacom Foundation has committed to upgrade and renovate, six have been completed and equipped with an ICT trolley solution and a mobile library.



Pillar 4

Communities.

These teacher centres are also technology hubs where members of the community can access the internet. More than 450 female farmers received ICT training at these centres.



Pillar 2

Infrastructure and ICT.

All 12 schools of excellence have computer centres and security – and the pit latrines were eliminated.



Pillar 5

Partnerships.

The Vodacom Foundation spends \$5 million each year as part of partnerships with 12 non-profit organisations. Over the past 20 years, these investments have impacted the lives of more than 73900 people.



Pillar 3

Teachers and school leadership.

Vodacom works with partners to provide teachers with training on ICT integration in the classroom. We have invested more than R12.7 million in 2018/2019 to provide unrestricted connections at 92 teaching centres and to train 92 centre managers in digital skills.



Pillar 6

Learning Materials.

With Vodacom e-School, a zero-rated platform for Vodacom customers, the Vodacom Foundation teamed with the Department of Basic Education (DBE) to offer free, unlimited internet access to high-quality digital Curriculum and Assessment Policy Statements (CAPS) aligned content and is available in all 11 South African languages. This means that the e-school service provided in collaboration with the DBE is funded entirely by Vodacom, who also bears the cost of providing it.

More about Vodacom e-School

Vodacom e-School promotes digital education as well as free access to quality education for students from Grade R to 12 in South Africa.

It provides students with digital learning materials, educational resources and support services through a cloud-based platform and includes various learning resources like interactive textbooks, multimedia content and assessments.

The platform was developed in 2014 and is available on mobile and desktop devices, free of charge, for all Vodacom customers. It provides teachers with professional development opportunities. It also offers the training and support they need to use digital technologies for teaching and learning and promotes blended learning, which sees traditional teaching methods combined with new technologies to enhance the learning experience for students. This includes assignments, quizzes and interactive learning videos.

"In primary school I struggled a lot with maths and physics. I was using Vodacom e-school and then I won the award nationally. Vodacom e-school is a very helpful platform. It's free of charge and you don't have to buy data. Another advantage is that you can learn anywhere you want."

Mack, Secondary School

The platform, which has more than one million users, makes learning more engaging, accessible and effective. By providing students with educational resources and proper support, Vodacom e-School is helping to improve educational outcomes and close the digital divide in Africa.





Providing more digital learning material on mobile devices

If students are mainly using mobile devices to learn, **we need to make sure that digital educational content and eLearning solutions are available on mobile devices.**

Worldreader is a non-profit organisation based in Ghana and works to improve the reading skills of children and young adults. Working with local communities and partners, it provides training and support to teachers, librarians and other educational professionals. Its work helps to support the development of a more knowledgeable, skilled and literate society in Ghana. Worldreader first brought e-reading programmes to schools, then libraries. Anyone with a data-connected phone can now access the ever-growing library of digital books.

"Change doesn't come in a day. It is a process. I am part of that process of making sure that reading reaches out to every corner of this world. Where I am standing today as a librarian is not where I stood in 2016 before the e-reading program with Worldreader."

Michael, Librarian

Kenya's eKitabu hosts more than 270 freely accessible digital storybooks on its cloud reader. With content available in Swahili, English, Kinyarwanda and Malawi languages, the platform focuses on the educational impact of books. eKitabu, innovate and design with users and partners from the public and private sector to increase accessibility and lower the cost of content for quality education. Since its founding in 2012, eKitabu has lowered the cost of delivering accessible content in local languages through open architecture, a global collection of digital content and ecosystem partners.

Accessible LMS

Some freely accessible and innovative learning management systems (LMS) aim to provide quality instruction and ease teachers' administrative tasks with a big focus on accessing them on mobile apps. Data analytics, bulk messaging and easily managed assessment as well as progress tracking help to give students speedy feedback when they need it.

Zeraki provides stakeholders with innovative technology tools to make teaching and learning effective, engaging, and productive. Stationed in Kenya, Zeraki is all about using technology to overcome some of the most difficult obstacles to delivering high-quality education in Africa. They offer access to high-quality education, cutting edge technologies that enable informed decision making, and administrative duties that were previously stressful. They strive to make educators' and students' lives better in every sphere of education.

"When the government announced closure of schools, we had not prepared any work for our students to do at home. Currently, my students can access assignments and video lessons from the comfort of their homes on phone through Zeraki Learning."

Zach, Teacher



"Because of the learning crisis created by the Covid-19 pandemic, many parents have been worried about how to keep their children engaged. Zeraki Learning provided a platform for my students to access interactive Chemistry and Biology lessons. With Zeraki Learning, digital learning is very effective!"

Dickens, Teacher - St. Mary's School, Yala

The service is available on the MySafaricom app. It enables students to access highly experienced teachers, watch online classes, take tests, and track their performance.





Making education easier with Zeraki

When you talk to Isaac Nyangolo about what it took to make Zeraki into the platform it is today, he is quick to point out that there have been so many incredible opportunities, partnerships and learnings along the way. He also notes that the edtech has changed quite a bit since it was launched back in 2014. For starters, Zeraki was initially introduced only as an interactive digital learning platform.

But Isaac and his co-founder, Erick Oude (who currently serves as Zeraki's COO) soon discovered that Kenyan schools needed more than this. The pair partnered with Safaricom to broaden the reach of their digital education platform and school management solution available to Safaricom customers. "A few years after we started Zeraki, we realised that information was actually a much bigger problem in schools," Isaac says. So, they added a management system to the platform, which schools can use to keep track of the administrative side of things like students' academic records, transcripts and attendance.

Every student needs a report card from their teacher at the end of each term so that students and parents can keep track of their progress, Isaac says. When we started the process of creating this platform, most of these report cards were created on a single computer sitting in the Dean's office. "At some schools, there would be as many as 60 teachers lining up outside the Dean's office to do the data entry needed to create these reports at the end of the term", he says. With Zeraki, teachers can upload their students' grades from their mobile phones and easily provide a performance breakdown for each student, subject or stream from anywhere.

There were also a few hurdles that needed to be addressed around the digital learning side of the platform. A few years after its launch, Isaac and his team found that schools were signing up for Zeraki but many weren't actually using it. They had about 60 schools sign up but, by their estimates, maybe only five to ten schools were using the platform on a regular basis. "We uncovered two key gaps. Firstly, many schools didn't have adequate infrastructure to support this kind of thing and, secondly, many of the teachers were keen to uncover new ways to deliver their lessons but didn't know how to implement technology in the classroom effectively", Isaac says.

While the pandemic has accelerated the appetite and need for digital learning tools across the country, Isaac says they are still lagging. "There are still fundamental gaps in training teachers around how to use digital learning solutions," he says. But this doesn't mean that schools or teachers aren't tech savvy, he stresses. "If you work in an office setting, there's always the IT guy who you call to fiddle with the projector or the HDMI cable to help the meeting go ahead. So, if tech-savvy companies feel the need to hire IT assistants it makes sense that schools might struggle if they don't have the right training or support to ensure that the tech works the way it should."

Looking beyond the classroom, Zeraki has also been designed to make sure that learning material was made available to students outside of the classroom too. They achieved this through their partnership with Safaricom, which makes it far more affordable for students to access Zeraki content. And these efforts are already making a mark.

Just ask students like James Salini and Jedidah Umazi who use Zeraki to improve their understanding of topics that they might have struggled to grasp in the classroom.

"It has helped me to find the answers to questions I didn't know how to answer. It has also enabled me to catch up on things that I didn't understand while the teacher was teaching," Jedidah explains. "Zeraki is an extraordinary app that makes teaching simple and fun across all devices, from mobile phones to laptops and desktops," adds Dem Antone Ondim, dean of students at a different school in Kenya. "With Zeraki, students can access learning affordably and they can share their experiences with others on the app and track their performance." Isaac says there are many determinants of success. "It's important to understand the problem you're trying to solve within a broader context," he says.

"When people think about the whole learning ecosystem, we focus a lot of our attention on digital learning and targeting students. But schools also need a lot of support when it comes to digitalisation and minimising time spent doing background administrative tasks. When teachers have less admin to do, they have more time to help students and cover the curriculum."

In addition to supporting parents with fee loans, more administrative tools are in the pipeline, like timetabling software. Zeraki has built an extensive distribution channel that covers almost half of the Kenyan high schools – while also solving other technology needs across the country.



Sterio.me is a Nigerian startup that gives students access to materials and lessons via an SMS on their mobile phones.

Pre-recorded lectures, quizzes and questions are sent for free using a specific SMS code. Educators are notified when students have finished the lessons and they can then review the performance of their students. Sterio.me does not require internet access and is available on any basic phone.

In South Africa, Obami is a free social learning platform. Students can connect with people from all over the world, get news from schools and submit assignments. The startup launched Obami Tutor in 2014, a mobile app that focuses on private tutoring for South African students. It connects students on their mobile phones to qualified real-life tutors. Obami Tutor revolutionises the traditional model of private tutoring by bringing quality and affordable help to any learner, anywhere in South Africa.

Launched in 2005, Genie also connects students with new learning opportunities. A long-term, large-scale national initiative developed and implemented by the Ministry of National Education and Vocational Training, Higher Education and Scientific Research of Morocco, it incorporates key pillars for developing an effective national ICT in education policy, including a focus on infrastructure, teacher training, the development of digital resources and encouraging digital transformation of teaching and learning practices.





Vodacom's Code Like a Girl programme develops coding skills for high school girls aged 14-18 years and encourages them to pursue a career in science, technology, engineering and mathematics (STEM) fields. During the week-long course, learners given a basic knowledge of computer languages, robotics, and development programmes that include HTML; CSS; GitHub and Version control; Bootstrap; JavaScript; Basic Computer; and Introduction to Coding. At the end of the week, each girl can develop her own website and present her work to the rest of the coding class. The programme has been running in South Africa, Mozambique, Tanzania, DRC and Lesotho since 2017. In South Africa, Vodacom has trained 732 girls since its launch and currently has 600 participants from close to 100 local schools. In Tanzania, Vodacom has trained 564 girls between April '22 to March '23 and over 1,700 girls in five regions since its launch.

Chapter 5. What African governments can do

What can African governments do to boost the impact of digital education?

We believe that the OPTIMAL Model is a good place to start. OPTIMAL stands for: Ordinance, Partnership, Training, Infrastructure, Mindset, Affordability and Leadership.

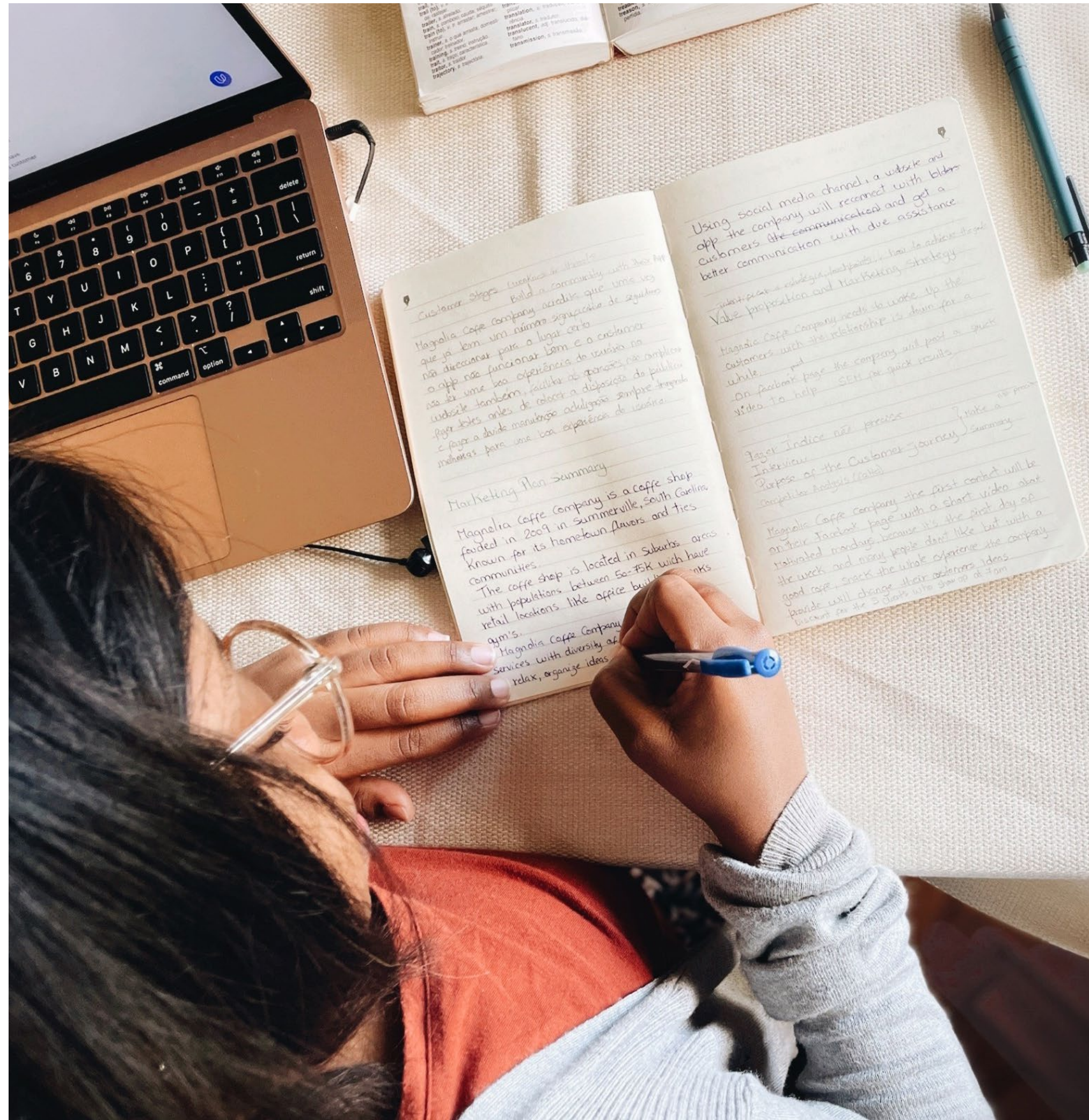
(O)rdinance: Create a positive regulatory ordinance that supports digital education

This means reviewing laws and policies that restrict access to social media, artificially inflate the costs of data and devices and make it more affordable for citizens to access the internet. Laws and policies should prioritise free and open access to educational content and learning materials so that any country can realise the benefits of digital education. This is especially true for citizens and students on the wrong side of the digital divide. Governments should direct education investments towards digital education by investing in tools that will make teachers and learners digitally proficient and progressively incorporate digital tools for measuring learner progress.

(P)artnerships: Build strategic partnerships that provide optimal coverage for digital education.

Realising the potential of digital education demands that we form strategic alliances between governments, corporations, universities, development agencies, technology companies and venture capital firms. Each partner brings a unique contribution to digital education; perspectives that complement the role of other critical partners. The result is improved capabilities, increased resources, enhanced reputation and shared expertise in digital education. Governments can support successful digital education programmes and help to amplify such programmes for greater societal impact.





Vodacom Mozambique's STEM Scholarship Programme bears fruit

Despite the fact that women make up around half of the population of Africa, they are grossly underrepresented in STEM careers. This means that scientific endeavours and technological innovation lack female perspectives and contributions.

Vodacom wanted to address this lack of diversity, so it partnered with Udacity to launch the STEM Scholarship Programme. The programme is aimed at young Mozambican women, aged between 20 and 35 years old, who are interested in pursuing a career in Information and Communication Technologies (ICTs). It promotes digital inclusion and reinforces digital skills, thus increasing job opportunities or creating opportunities.

Nágila Lucas is one of the beneficiaries of the scholarship. She first learned about the programme when she saw an advert on LinkedIn and was instantly curious. The 28-year-old from Maputo saw the scholarship programme as a chance to grow both personally and professionally. "I was particularly interested because there was an opportunity for me to gain further skills in the work I already do, which is in the field of digital marketing and advertising," she says. Some of the topics Nágila learned about as part of the Digital Marketing Nanodegree include marketing fundamentals, marketing data and technology and social media marketing.

Today, Nágila is using the skills she has gained from her studies to start her own digital marketing business. "I can confidently say that I am a different person today from who I was before I started the programme. I have more faith in myself, in the skills I have and in what I can add to the market through my business." When asked what inspires her to pursue this work, she mentions other female entrepreneurs who work hard and fight everyday to challenge the many stereotypes around what women can and cannot do. The many women who are already leveraging digital tools and technologies to think outside of the box and to ensure that their voices and perspectives are heard are a prime example of this.

"I would definitely encourage other women to apply for this scholarship because it is something that can really change their lives," she says, noting that developing a sense of independence is a major benefit of opportunities like these. "With skills like this, more women can start their own businesses. More women can work for themselves. They don't have to depend on anyone. They don't have to search for jobs. They can achieve their dreams and overcome any challenges and, hopefully, inspire other women to do the same."

(T)raining: Commit to continuous training in digital technologies to build a sufficient base of human capital that supports and sustains digital education.

Training teachers and students in digital skills is foundational to the success, scaling and sustainability of digital education. Vodacom's 92 teacher training centres include upskilling programmes that develop technological competencies and skills within schools and communities. At the national level, there are 'tech professionals' who need to be trained in the development and maintenance of technology-based systems that support digital pedagogies through the education and training system. The rapid pace at which new technologies for teaching and learning are being developed and deployed means that retraining and the retaining of technical expertise is vital to support digital education on a national and continental scale. A comprehensive strategy is required and universities can play a key role as sites for training and development in basic, intermediate and advanced skills for digital education.



(I)nfrastructure: Invest in digital infrastructure through planned and consistent funding.

This will require an Africa-wide broadband infrastructure project to which every African government commits sustainable funding for optimal coverage across the continent (K4). Digital infrastructure includes internet backbone, broadband, mobile telecommunications, data centres, connection networks, communication satellites and, importantly, a technology talent pool. The barriers that inhibit access to spectrum and the safe movement of data must be removed to ensure that digital infrastructure can be rapidly deployed and networks can be modernised to later technologies such as 4G and 5G.

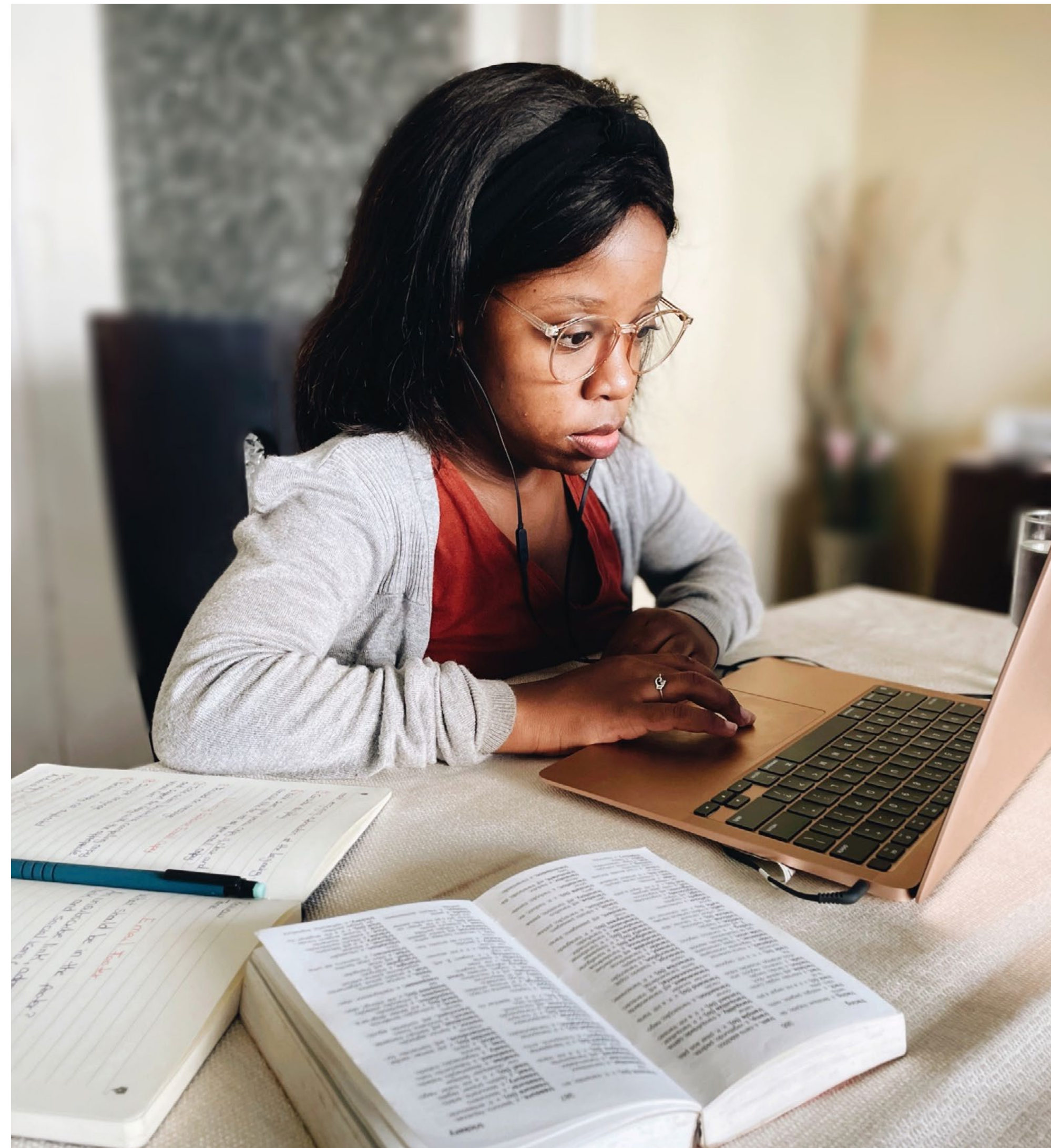
Digital infrastructure is capital intensive and, therefore, governments must implement policies that attract and incentivise investment in digital infrastructure by the private sector. Given the low coverage in Africa, without such infrastructure investment, most educational facilities will not be able to optimise classroom-level resources for digital learning.

(M)indset: Cultivate a digital mindset in the education user community.

Just one quarter of people in Africa are connected to the mobile internet. Others lack coverage or cannot use the internet for several reasons. Those unconnected despite coverage might simply lack a digital mindset. A digital mindset is defined as a positive set of dispositions (beliefs, attitudes and behaviours) towards digital technologies that come from recognising how these tools can transform teaching and learning. Those with a digital mindset tend to be curious, persistent experimental, agile/flexible, proactive and hungry to learn more. This mindset can best be cultivated through training, demonstration, modelling, rewarding, incentivising and affirming the digitally inclined. In addition, it is also important to support locally-produced digital content, like films, artwork and music.

(A)ffordability: Increase access to digital education through greater affordability.

Lowering the costs and/or increasing funding for data and devices should be a critical element of the digital transformation agenda in education and society. Universal digital learning costs are within the reach of African governments working with development partners and the private sector. Governments can make mobile devices more affordable by reducing taxes and can also promote programmes that make recycled devices available to the most marginalised communities.



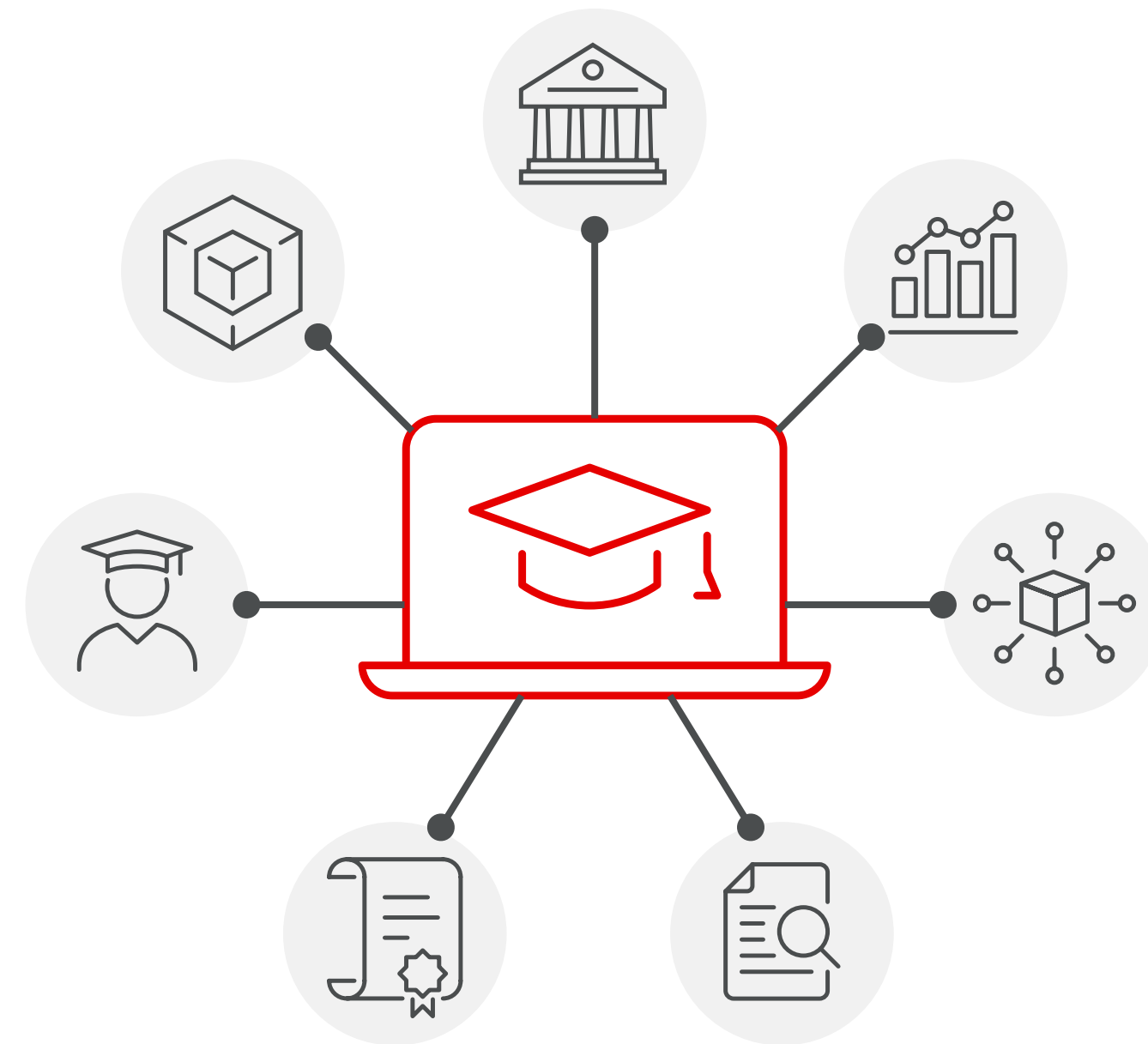
(L)eadership: Demonstrate digital leadership throughout the education and training system.

Countries that are successful with digitalisation, have digital leadership at every level of the education and training system; at national, provincial, district and local levels. Digital leadership has several functions that include setting a vision, aligning policies, communicating plans, giving direction, coordinating efforts, influencing people, building synergies, enabling innovation and mobilising resources. This kind of leadership is as important at the school level as it is in the upper echelons of government.

Chapter 6. An idealised plan for the digitalisation of education in Africa

The model presented here recognises that in the real world of turbulent politics and uncertain economics, governments seldom align policy, planning, and programming in ways that deliver perfect designs for digital transformation. However, the model allows us to see what could happen if all elements of digital transformation in the education space were aligned to realise the lofty goals of SDG 4.

The sourcing of these ideas comes from a close examination of digital transformation strategies in a mix of African countries. **Our research shows that no single African country reflects all elements of digital transformation, but some among them include one or more of these strategies in their education strategies.** The model consists of seven elements of an effective strategy for digital transformation.





1. Embed digital transformation across government

Many African governments now have ministries and departments dedicated to digital transformation.

These are responsible for leading the digitalisation of government, business and education across every aspect of the national economy.

Examples include business intelligence dashboards in Djibouti, national digital IDs in Kenya and Uganda and Ethiopia's Woreda Net, which uses terrestrial satellites to provide connectivity to different levels of government.

In education, a centralised curriculum policy that introduces digital education in the foundation years of schooling (e.g., coding in early primary education) is already available in some African countries.



2. Reallocation of national budgets for digital transformation

Boosting government support for digital transformation in education requires a massive reallocation of national budgets, whether measured as a share of GDP or as a percentage of overall expenditure. While multi-stakeholder funding is clearly needed to advance digital education, none of this is possible without a restructuring of national government budgets as one component of a broad strategy for resource mobilisation.

Estimates suggest that the gap in annual funding required to meet the goals of SDG 4 is almost \$2 trillion for low- and lower-middle-income countries.

Available data shows that for the Middle East and North Africa (MENA), government investment in IT infrastructure has grown from \$13.55 billion in 2020 to \$16.7 billion in 2022.

The Rwandan government is often considered an exemplary case for digital transformation success given its large investment in digital infrastructure; 90% of the country have access to [fixed] broadband and 70% of the population have access to cell phones (UNICEF, 2019).

But given the sheer scale of funding required, state budgets alone are not enough. The South African government, for example, has launched a Digital Development Fund to generate funding to support the development of digital skills, with earmarked grants for basic education. Kenya, ranked 14th globally in this indicator, attracted \$10 million in venture capital funding for its digital transformation.



3. Enable, connect and expand small-scale, localised digital education projects

A sober assessment of the political economy of African states suggests that an African-wide broadband infrastructure will take many years. Meanwhile, African governments face an increasing digital divide that defines the landscape of education and technology. But there are a number of local initiatives spurring on digital education.

These include the Digitruck innovation in Kenya that brings digital education and training to teachers and youth in remote and rural areas of Kenya; Vodacom's Code Like a Girl that brings STEM education to girls as an underrepresented

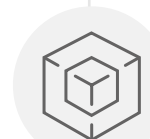
group, teaching them coding and soft skills for science careers in countries like Lesotho and Mozambique; Vodafone's Instant Network Schools which, working with a UN Refugee Agency, provides digital education (learning content and internet services) to refugee communities in six African countries, including South Sudan and the Democratic Republic of Congo; and the non-profit organisation, Worldreader, which has successfully delivered e-readers with teacher support to promote digital reading in Ghana and other African countries.

Given this plethora of digital education initiatives within and across countries, what can African governments do?

They can:

- Provide favourable conditions for localised initiatives to flourish;
- Make education officials learn from and participate in these programmes as next-level trainers;
- Lower the costs of operations through co-funding schemes thereby becoming a recognised partner in digitalisation;
- Open schools and other learning centres to benefit from new digital innovations;
- Consider reorganising school schedules for optimal participation in online or hybrid education;
- Invest in local innovations in digital education so that Africa is not simply a recipient of largesse from international governments, development agencies or private companies;
- Regulate mobile data pricing strategies.





4. Transform teacher education to meet the demands for digital teaching

The pandemic caught many teachers around the world off-guard on new education technologies. Teaching and learning remotely meant that many teachers were instantly required to learn how to teach virtually or in a blended mode. Older teachers and those in under-resourced or rural schools particularly struggled to make the transition that required familiarity with a range of new technologies. Unfortunately, many of the teacher education institutions (colleges, universities) have not rethought teacher preparation for the digital age.

Whether through INSET (in-service education of teachers) or PRESET (pre-service education of teachers), the digital teacher requires a completely new skill set. They must be able to facilitate learning across many modalities: face-to-face (in the classroom) and virtual (online); synchronous and asynchronous; analogue and digital. Teachers have to master the full range of available digital tools for teaching and learning. They must move learning material online and customise it to the demands of the national curriculum. Teachers themselves must embrace a digital mindset so that they are constantly upgrading their skills to deliver teaching with new technologies. And they need to learn how to connect with fellow teachers in technology-supported learning environments.

These new demands on digital teachers require a complete overhaul of existing teacher education programmes across the African continent.

In response, several digital initiatives focused on teachers have emerged to help teachers keep up. Deviare, for example, is an online learning platform adopted by the University of South Africa (UNISA) that provides teachers with the digital capabilities and the confidence they need to facilitate learning in a conventional classroom or at remotely. The Quality Holistic Learning (QHL) Project distributes teacher professional development (TPD) material as open educational resources (OER) for teachers working in displaced communities in remote areas of Niger, Chad and Kenya; (these are also the least digitally connected areas of Africa, hence this innovative “digital TPD” intervention). And one of the largest OER platforms, Teacher Education in Sub-Saharan Africa (TESSA), provides online materials in four languages to a variety of African countries to support both teachers and teacher educators.

What these innovations underline is that the digital transformation of formal teacher education programmes in schools and universities is a lot slower than what is available elsewhere.

In an ideal situation, the national government would call for and fund the transformation of formal teacher education so that the next generation of educators is prepared for digitally-driven teaching and learning from the start. However, such formal preparation would not reduce the need for in-service upgrading or upskilling that is inevitable for on-the-job training as new technologies come onto the education market.



5. Prioritise digital inclusion in education

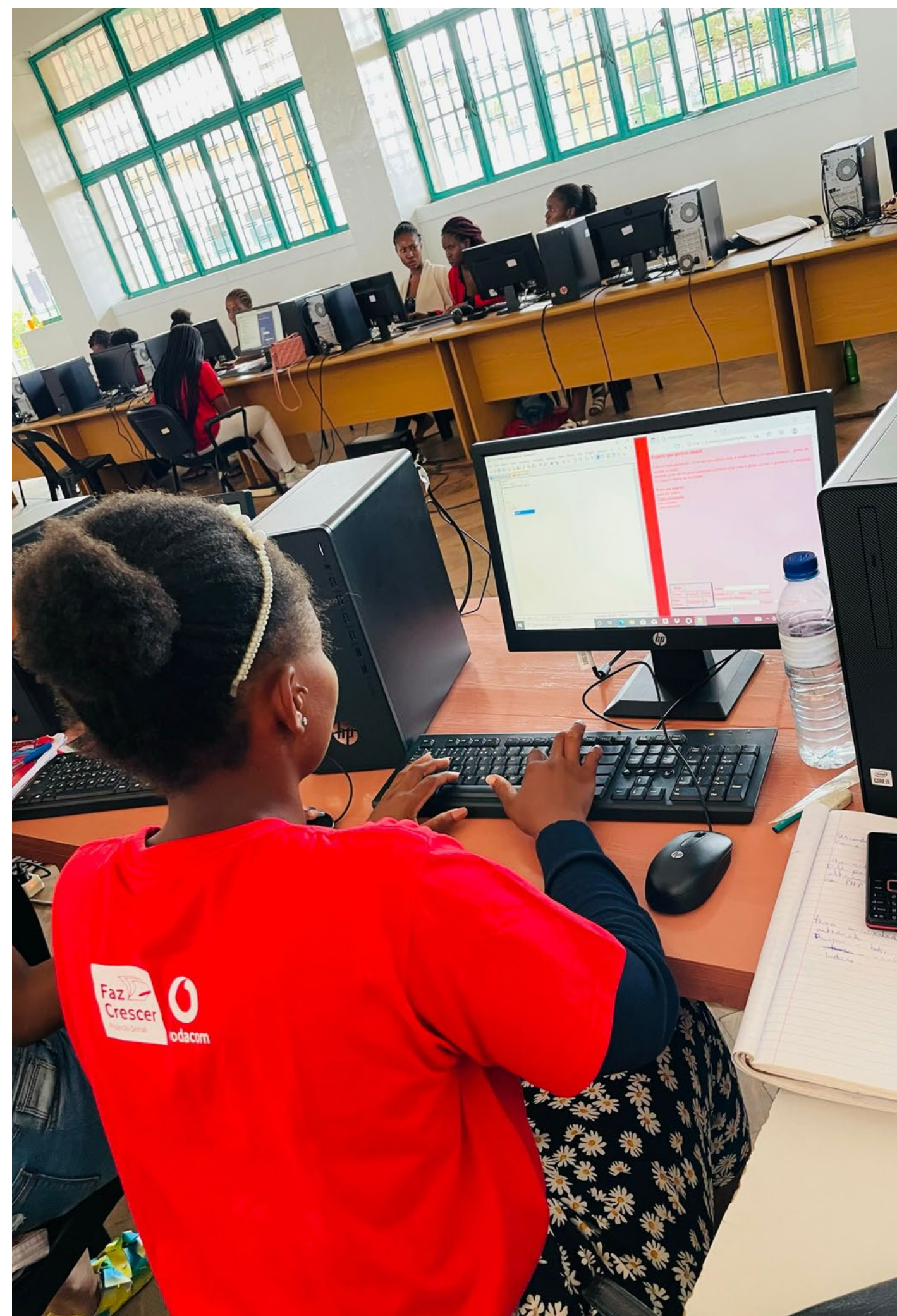
Digital inclusion in education is defined here as the capacity for all students and teachers to access and use the full range of digital resources available regardless of who they are (e.g., girls), where they are (e.g., rural), and what they can afford (socio-economic status).

When it comes to education, Africa has the most significant digital divide in the world. While there are exceptions, the divide does not only exist between African countries but also within countries. In countries like South Africa, with long and enduring histories of division by race, class and gender, the digital divide reinforces the enduring inequalities that were entrenched by colonialism and apartheid.

African governments committed to digital inclusion must several things across education and development policies to address this divide.

These measures include:

- Rolling out a comprehensive digital literacy programme.
- Ensuring that digital education initiatives target those most excluded from formal education, such as illiterate and unconnected citizens or refugees.
- Customising digital content for the most excluded by presenting material in local languages with highly usable interfaces and engaging content.
- Building digital infrastructure in remote geographic areas as a priority in its national strategy.
- Adequately designing, funding, monitoring and leading a well-thought-out digital inclusion policy.



For the most part, digital inclusion programmes are more likely to be driven by non-government agencies in Africa than by African governments themselves. For example, the UNESCO-Pearson Initiative for Literacy in Malawi and Ghana drives digital inclusion in areas such as health education.

Digify Africa works with a UK government initiative, the Digital Access Programme, to reach 150,000 people in rural South African communities to promote digital literacy, and boost access to digital tools and services (UNESCO, 2021). However, there are some impressive government-led initiatives for digital inclusion in education.

The Rwandan government's Smart Classrooms initiative, launched through an agreement with Microsoft, has dramatically expanded internet services and digital education first in urban areas like Kigali, but also in more than 22,500 new classrooms in 30 districts of the country, with financial support from the World Bank. Similarly, the Kenyan government became a leader in the digital education space by increasing the reach of electricity at schools from 46% national coverage to about 92%. This allowed private partners such as Zeraki, a video and digital learning platform, to reach around 45% of Kenya's high schools.



6. Establish a policy and planning platform for digital education

Nothing binds national resources together behind a common goal more than a coherent plan to meet official commitments. A policy or plan for digitalisation in general, and digital education, is a signal of intent. It outlines key objectives. It sets out the expectations of various stakeholders within and outside of government. It might define start and completion dates. It gives a sense of location for that policy, for example, the president's office. It spells out the role of various funding agencies or sources. It specifies the target population.

What does a policy and planning platform look like in Africa? Government plans for digital education must, of course, align and correspond with national policies and plans for digitalisation. The most obvious starting point would be the national curriculum as an overarching policy statement, which, in the case of South Africa, now stipulates that coding will be introduced into primary school education. UNESCO has developed an ICT Competency Framework for Teachers (**UNESCO's ICT Competency Framework for Teachers, 2023**) that has been made available around the world and adopted as a policy guideline by some African governments.

Kenya's Competency-Based Curriculum recommends digital literacy as an important competence that teachers must acquire to deliver on new curricular demands. Whether it is curriculum, assessment or pedagogy. Policies and plans should be in place to guide teaching and learning in line with national imperatives for digitalisation and digital education.

African governments are increasingly designing policies and plans for the digital world, including everything from e-government services to digital education in classrooms.

In any of these efforts, it is imperative that governments develop policies on digitalisation for practical purposes. To do so, there must be strong political will on the part of governments to move beyond policymaking and promote action. No government wants to be seen as unresponsive to global trends; particularly when these trends are widely promoted and championed by organisations such as the World Bank, UNESCO and the African Union.





7. Exercise political will with respect to the digitalisation agenda in education.



There is no shortage of policy commitments to the digitalisation of education among African governments. Some of those are agreements made with multilateral organisations like UNESCO and others are continental pledges made through bodies like the African Union. But few governments have demonstrated the drive and funding needed to accelerate the digitalisation of education. On the one hand, this is understandable given the many challenges that governments across the continent face, from civil war to economic distress and natural disasters.



However, the failure to take advantage of the historical opportunity that digital technologies offer society means that many countries across Africa may miss out on the available social, economic and educational benefits digital transformation brings. Where there is political will, governments are prepared to go well beyond the symbolic functions of policy, by adopting a progressive position on digitalisation and driving change from the top.

Any government that exercises political will should:

- Place digital education as a recurring item on the national development agenda;
- Devote sufficient resources to digitalisation efforts;
- Actively raise funds on a national, and international level, to ensure that there is an adequate resource base to fund their plans; *Dedicate senior staff in politics and bureaucracy to drive the process of digitalisation through a “whole-of-government approach”;
- Demand direct reporting to a senior member within government, such as a cabinet minister who demands regular monitoring and evaluation of progress;
- Include some reference to the prioritisation of digitalisation and digital education in all speeches made by any politician or bureaucrat;
- Understand that political capital must be spent to ensure participation at all levels of governance;
- Keep their foot on the pedal to ensure that there is no letting up in the drive for digitalisation in education and society.

This is what some would call “the strategic state” and others “purposeful governance”.

There are various available indices that categorise the African government by the degree to which digitalisation enjoys the highest levels of political support.

A 2022 Regional Network Index found that Rwanda performs best in key performance pillars related to readiness for digitalisation, namely, technology, people, governance and impact. Kenya’s government is in the top ten rankings globally in terms of internet bandwidth. South Africa performs best in population coverage on the 3G mobile network indicator.

What these measures show is that some African governments can and do demonstrate political will on digital transformation but it is essential that this political rhetoric is matched by a driven leadership that gives effect to policy ideals. Without demonstrated political will on the part of African governments, there can be no digital transformation in education and society.

Conclusion

While access to education has improved across Africa, educational outcomes have not. The use of technology in education holds incredible potential to improve the quality of education on the African continent. But there are many barriers to digital education success – from unreliable electricity and limited connectivity to affordability, social norms and political instability. Despite these, there are some inspiring examples that showcase what can be done when the right people, with the right ideas come together to develop and deploy the right solutions.

Given the substantial barriers, finding success is not a simple task. A multifaceted approach, which understands and considers the economic, social, and political environment, must be adopted. It must unite different stakeholders – from government all the way down to civil society – to work together to ensure that Africa's youth can benefit from technology, particularly online learning platforms and resources. Africa has the youngest population in the world. Some 70% of sub-Saharan Africa is under the age of 30. This high number of young people presents an incredible opportunity for growth and development across the continent. But it is only an opportunity if we ensure that these young Africans are equipped with the knowledge and skills they need to fully participate in the digital economy from a young age.



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