

Internet for Education in Africa

Helping Policy Makers to Meet the Global
Education Agenda Sustainable Development Goal 4

May 2017



Internet
Society



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Acknowledgments

Education and the Internet are important global assets, and have transformed the lives of billions of people. Considerable progress has been made in education and Internet connectivity worldwide over the last three decades, but the intersection between these two is far from reality in Africa. Commitments and actions of the policy makers, teachers, principals and parents are essential to unlock the potential of the Internet for learning and to meet the global education for sustainable development.

This report was initiated by Dawit Bekele who highlighted the growing importance of the Internet for education, and the necessity of good policy making on learning powered by the Internet. Dawit provided overall guidance and input during the preparation of the report. The report has also benefited from the insights of Jane Coffin, Carl Gahnberg, Erin McGann and Constance Bommelear, who provided valuable input and guidance.

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The report draws on multiple perspectives from both developed and developing nations. It has benefited from the efforts of the World Bank, the United Nations Educational, Scientific, and Cultural Organization, the Commonwealth of Learning, the Organization for Economic Co-operation and Development, the European Union and other bilateral organizations like the United States Agency for International Development that have invested in education technology over the last two decades. The paper also drew on national and regional initiatives spanning Information and Communication Technologies (ICT) in education policy, infrastructure development, teacher training, Open Educational Resources, and research and education networks. The authors would like to thank Michael Trucano of the World Bank, who, through the EduTech Blog, made available insightful information on initiatives, challenges and opportunities on ICT integration in general education.



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Executive Summary

This report reviews the potential implications of Information and Communication Technologies (ICTs) in general, and the Internet in particular, for education in Africa. The Internet is a cross-cutting enabler for education. It provides unparalleled access to information, and facilitates connections to educational resources, virtual labs, ideas and people. However, access to the Internet is not distributed equitably around the world. The African region is one of those lagging very much behind in bringing Internet connectivity to schools, colleges and out of school learners.

The report assesses how the Internet is being used in the education sector in this region and elsewhere, and how it can be harnessed to address the pressing needs of the education sector in Africa within the framework of the Global Education Agenda (the Sustainable Development Goal 4) adopted by the United Nations. It provides recommendations on the roles of policy makers in encouraging learning powered by the Internet over the next decade.



Photo: Seth Doyle

Why Does the Internet Matter to Learning in Africa?

Education is the basis for social and economic development. For Africa, a skilled workforce that utilizes ICTs effectively is a key factor in determining its competitiveness in the global digital economy and for harnessing its natural resources for sustainable growth.

The region faces considerable challenges in education ranging from the absence of quality teachers, outdated or unavailable learning and teaching materials, and inadequate physical space (school infrastructure) for fast-growing learners. Over 110 million school children between 6-18 years of age are out of school in Africa. Thirty-seven million young people require technical and vocational training and/or other forms of education that facilitate paths to their employment. Only about 6 percent of secondary school graduates find places in higher education in sub-Saharan Africa.

The Sustainable Development Goal for Education (SDG4) commits countries to addressing these challenges and attaining universal pre-primary, primary and secondary education and gender equity, and promoting youth learning for employability. Such commitments require innovative approaches that go beyond simply building more educational institutions. One such innovative approach involves using educational technology in various ways.

The opportunities for using the Internet for learning are numerous in Africa. According to the International Telecommunications Union (ITU), more than a quarter of the African population (341 million) had access to the Internet as of 2016, the majority of which are potential Internet learners. Over half the population has access to mobile phones. Countries have also seen improved broadband connectivity at national levels (through national backbone networks) and internationally through a variety of submarine cables that landed on the western and eastern coast of the continent over the last decade. There is enough broadband capacity that can be used to serve the countries' efforts to meet Sustainable Development Goals in general, and to facilitate interactive and equitable learning in particular.

The full integration of ICTs and leveraging the Internet for education requires clear vision and strategy, and most importantly, commitment accompanied with investment in equipment, broadband connectivity, learning resources, and technical support.

Awareness of what is possible and what is already available for parents and teachers is also crucial for students to benefit from the vast learning resources already available on the Internet.

The Internet Society's goal is to make the Internet available to everyone, everywhere, especially to those constrained by lack of access to infrastructure, due to high costs, limited skills and absence of locally relevant content. Internet Society has developed an Internet Enabling Environment Framework¹ that provides overall guidance to developing countries for addressing these challenges. The Framework highlights the necessity of encouraging infrastructure investment, fostering skills and entrepreneurship, and establishing supportive governance for the Internet ecosystem. This policy paper aims to contribute to Internet Society's efforts in promoting access to the Internet, with a particular focus on clear and holistic policies for ICT in education in Africa.

¹ Internet Society, A Policy Framework for Enabling Internet Access
<http://www.internetsociety.org/doc/policy-framework-enabling-internet-access>

Lessons from Global Practices in Integrating ICT in Learning

The last two decades have seen a variety of innovations in education delivered over the Internet. Many countries, including Antigua and Barbuda, Argentina, Brazil, Chile, Dominica, Finland, Ghana, India, Kenya, Korea, Malaysia, Namibia, Nepal, Peru, the Philippines, Singapore, South Africa, Turkey, Tanzania, United Kingdom, United States, Uruguay and Zambia have been making progress in drawing up comprehensive policies for ICT in education, providing students and teachers with necessary equipment (e.g. one-to-one computing), connecting schools to the Internet and supporting the development of National Research and Education Networks (NRENs). Progress with Open Educational Resources (OER), Massive Open Online Classes (Courses), cloud computing, and mobile learning has also created options for expanding learning opportunities anywhere and anytime.

The experience of these countries highlights the importance of a holistic and integrated approach to ICT introduction into the entire education system, the necessity for graduation from collective ICT access in schools through computer labs towards one-to-one computing, and the importance of blending online learning with face to face interaction with teachers. These experiences also stress the centrality of teachers' professional development and incentives. The experience in Uruguay, detailed in this paper, for example, suggests that thousands of ICT volunteers can be mobilized to address the two fundamental challenges facing massive ICT introduction in schools: maintenance, and content creation and adaptation.

Furthermore, global experiences show that access to ICTs and adoption of learning materials should be paired with clear guidelines for measurement and assessment of ICT in education. The growing use of videos and interactive platforms available through Massive Open Online Courses (MOOCs) and other forms of Open Educational Resources also means the low-bandwidth environments in many countries in Africa cannot support interactive (gamified) lessons; thus efforts should be made to improve broadband connectivity in the region.

State of Internet for Learning in Africa

There is no reliable data on the use of the Internet for learning in Africa. Investment in ICT in education to date involved the rollout of Schoolnet projects and the establishment of NRENs. Schoolnet projects typically begin with equipping selected "league schools" with computer labs, training teachers, and where possible, providing students and teachers with learning materials.

Despite efforts over the last two decades, there has been limited success in rollout of ICTs and the Internet in African schools, because of lack of resources and the absence of a holistic and integrated vision and strategy. There is a great need for governments to advance inclusive knowledge societies, taking into account the Internet universality principles adopted by the UNESCO's General Assembly that advocate for a human rights-based open and accessible Internet to all.²

² Unesco, Outcome Documents of the "Connecting the Dots: Options for Future Actions" Conference <http://unesdoc.unesco.org/images/0023/002340/234090e.pdf>

It should be noted that the progress varies from one country to another. The improved broadband connectivity in countries like Botswana, Egypt, Kenya, Morocco, Rwanda, Senegal, South Africa and Tunisia has already enhanced learners' and teachers' access to the Internet. In other countries, connections to the Internet are limited. Despite the promises and significant penetration of mobile phones across the continent, mobile learning did not take off in Africa, because of high communications costs, low bandwidth, low penetration of smart phones and the absence of locally relevant applications on mobile devices.

The situation in the Technical and Vocational Education and Training (TVET) institutions is not very much different. In the TVET environment, there is a tendency to treat ICTs as a vocation rather than an enabler for learning. Internet access is confined to computer labs or libraries of the TVET institutions.

Internet access has been improving in higher education institutions, thanks to efforts by champions in establishing National Research and Education Networks, and due to the funding from development partners such as the European Commission and the World Bank. However, the progress with NREN formation varies considerably, with only universities in Algeria, Egypt, Kenya, Morocco, Senegal, Tunisia, South Africa, Uganda and Zambia attaining acceptable degrees of access comparable to their peers in developing south (i.e. Asia and Latin America).

Governments' lack of strategic vision and their limited capacity in terms of drafting holistic policies and strategies on learning powered by technology is one of the constraints to date. The efforts to bring gender equity as well as promoting equitable access to disabled people and ensuring child safety are very low in Africa. Efforts are underway in many countries to collect Educational Management Information Systems (EMIS) data; yet this has not been used effectively to monitor the progress in education in general, and to assess the impact of ICT use in particular.

Role of Policy Makers in Unlocking the Potential of the Internet for Learning

Policy makers have crucial roles in creating the necessary ecosystem for ICT integration in education. The improved connectivity in the region and the vast learning resources that are available over the Internet can be harnessed to advance access and quality of education in Africa. Policy makers primarily need to articulate a holistic vision for a blended form of learning by crafting and implementing an ICT for education policy that covers the entire spectrum of learning (pre-primary, primary, secondary, TVET, higher education, distance, on the job and lifelong learning). Through the ICT in education policy:

- Policy makers need to address three interlinked areas proposed by the Internet Society Enabling Environment Framework – namely, promoting infrastructure investment, fostering entrepreneurship and skills, and promoting supportive governance.
- Policy makers need to ensure affordable broadband connectivity is available to schools, colleges and universities to facilitate real time interaction. Efforts are also needed to extend access to electricity, that often constrains the use of Internet for learning. It is also essential policy makers advocate for and promote 21st-century buildings that make blended forms of learning a reality.

- Regulators and decision makers need to create an enabling environment for private sector investment in infrastructure and content. They need to set the principles and rules that promote services, applications and human capacity development.
- ICT in education initiatives should also ensure that teachers are given a prominent role, their skills upgraded, and incentives put in place to reward their efforts in ICT integration in teaching, learning and assessment processes.
- Policy makers need to strive to participate in the global efforts for promotion and exchange of Open Educational Resources (OERs) as outlined in the Paris Declaration of OER. They need to support local efforts that promote creation, adaptation and exchange of learning resources.
- To promote inclusion and attain the educational goals of SDGs, attention should be given to gender equity and unconstrained access to learning powered by technology to disabled people. Furthermore, there is a need for addressing digital safety issues, either through capacity building for youth, teachers and children and/or by creating legislative frameworks and enforcing them. Governments need to support all technical, legal and institutional means to reduce risks to children.
- A significant gap exists in applying ICTs for job creation and using it for training youth to tap into global ICT Enabled Services. This requires initiatives that stimulate a blended form of learning that combines traditional and online education in TVET institutions, for example by encouraging access to state of the art education available through MOOCs and other Open Educational Resources.
- Policy makers need to stimulate NRENs by supporting access to broadband infrastructure, and ensuring that budgets for NRENs are allocated centrally. Regulators can also play a great role by ensuring that NRENs and schools have access to high bandwidth under favourable commercial terms, allocating a portion of the Universal Service Funds and providing them with preferential access to the radio frequency spectrum.
- Data and research are key to assess the impact of the investment of ICTs in education. Policy makers need to invest in data gathering on ICT access and use by students and teachers, and support centers of excellence that undertake research and disseminate it to improve learning from previous experiences.

I. Introduction

Data from the ITU shows that over a third of the African population has access to the Internet today, and the potential of the Internet to transform the traditional closed, static education to a learner-centered and interactive model is very high. Trends in digital classrooms, cloud computing, MOOCs, social media, one-to-one computing and mobile learning have increased reach and opportunities for using the Internet for learning without the constraint of geography, disability, gender and other social and economic divisions.

At the same time, ICT-based learning cannot succeed without other ingredients. It works when learners secure the skills and attitude to succeed in the globalized knowledge economy, where quality and motivated teachers and facilitators integrate technology in teaching, learning and assessment, and where parents, school principals or university leaders embrace it. The Internet works well where and when the barriers of connectivity, cost, access, use, and electricity are dealt with head on. These barriers cannot be met without the commitments and actions of policy makers, educators and other stakeholders.

The Internet Society's goal is to make the Internet available to everyone, everywhere, especially to those constrained by lack of access to infrastructure due to high costs, limited skills and absence of locally relevant content. Internet Society has developed an Internet Enabling Environment Framework³ that provides overall guidance to developing countries for addressing these challenges. The Framework highlights the necessity of encouraging infrastructure investment, fostering skills and entrepreneurship, and establishing supportive governance for the Internet ecosystem. This policy paper aims to contribute to Internet Society's efforts in promoting access to the Internet, with a focus on policies for ICT in education in Africa.

This report reviews the potential implications of ICTs in general, and the Internet in particular, for education in Africa by asking some basic questions.

The report assesses how the Internet is being used in the education sector in this region and elsewhere, and how it can be harnessed to address the pressing needs of the education sector within the framework of the Sustainable Development Goals (SDG). It provides recommendations on the roles of policy makers in encouraging learning powered by the Internet over the next decade.

Key questions posed by this report:

- Why does the Internet matter for education in Africa?
- What experience exists elsewhere in using ICT and the Internet for education?
- What is the current context of ICT/Internet use in education in Africa?
- What should policy makers do to unlock the transformative power of ICT/Internet for learning over the next decade?

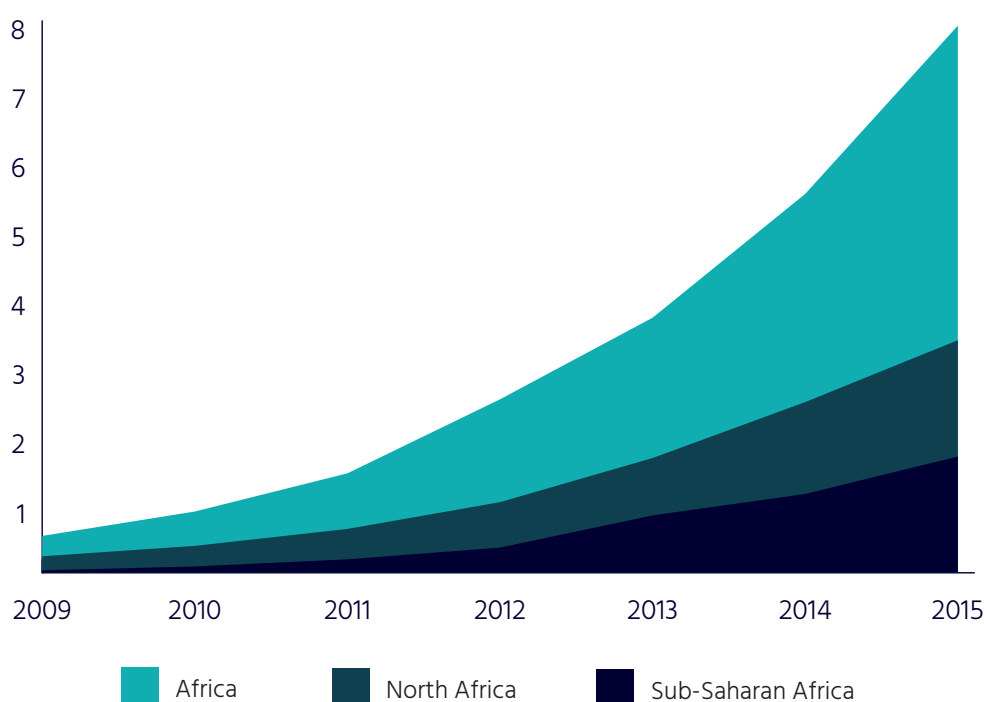
³ Internet Society, A Policy Framework for Enabling Internet Access, <http://www.internetsociety.org/doc/policy-framework-enabling-internet-access>

2. Education Challenges in Africa and the Role of the Internet

2.1. Internet Connectivity in Africa

The African continent has seen the growth of Internet connectivity in recent years, mainly due to availability of undersea cables and ubiquity of mobile phones. The total international bandwidth has reached close to 4.5 Terabits in 2015, and will rise higher following connection of the region to more submarine cables after 2009⁴.

Graph 1



Source: Africabandwidth Maps, <http://www.africabandwidthmaps.com/?p=5186>

The number of Internet users has also seen an upward trend since then. ITU data indicates that number of the Internet users has doubled since 2009 to 25 percent in early 2016⁵. While this shows an upward trend, about three-quarters of the African population does not have access to the Internet today. Moreover, there is a significant diversity in Africa, with only a few well-connected countries like Kenya, Mauritius, Morocco, Nigeria, Seychelles, South Africa, and Tunisia attaining a connectivity level of around half of the population. These countries also lead in utilizing the Internet for education.

⁴ <http://www.africabandwidthmaps.com/?p=5186>

⁵ International Telecommunications Union, Internet Facts and Figures, 2016
<http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf>.

Table 1. Internet Penetration in Africa

| Country | Estimated population | Internet users | % of population |
|-------------------|----------------------|----------------|-----------------|
| Algeria | 41,063,753 | 15,000,000 | 36.50% |
| Angola | 26,655,513 | 5,951,453 | 22.30% |
| Benin | 11,458,611 | 1,232,940 | 10.80% |
| Botswana | 2,343,981 | 690,000 | 29.40% |
| Burkina Faso | 19,173,322 | 1,894,498 | 9.90% |
| Burundi | 11,936,481 | 526,372 | 4.40% |
| Cabo Verde | 533,468 | 224,183 | 42.00% |
| Cameroon | 24,513,689 | 4,311,178 | 17.60% |
| CAR | 5,098,826 | 224,432 | 4.40% |
| Chad | 14,965,482 | 387,063 | 2.60% |
| Comoros | 825,920 | 60,000 | 7.30% |
| Congo | 4,866,243 | 400,000 | 8.20% |
| Congo, Dem. Rep. | 82,242,685 | 3,101,210 | 3.80% |
| Cote d'Ivoire | 23,815,886 | 5,230,000 | 22.00% |
| Djibouti | 911,382 | 150,000 | 16.50% |
| Egypt | 95,215,102 | 34,800,000 | 36.50% |
| Equatorial Guinea | 894,464 | 181,657 | 20.30% |
| Eritrea | 5,481,906 | 67,000 | 1.20% |
| Ethiopia | 104,344,901 | 4,500,000 | 4.30% |
| Gabon | 1,801,232 | 670,197 | 37.20% |
| Gambia | 2,120,418 | 373,865 | 17.60% |
| Ghana | 28,656,723 | 7,958,675 | 27.80% |
| Guinea | 13,290,659 | 950,000 | 7.10% |
| Guinea-Bissau | 1,932,871 | 84,000 | 4.30% |
| Kenya | 48,466,928 | 31,985,048 | 66.00% |
| Lesotho | 2,185,159 | 444,376 | 20.30% |
| Liberia | 4,730,437 | 395,063 | 8.40% |
| Libya | 6,408,742 | 2,800,000 | 43.70% |
| Madagascar | 25,612,972 | 1,300,000 | 5.10% |
| Malawi | 18,298,679 | 1,160,839 | 6.30% |
| Mali | 18,689,966 | 2,212,450 | 11.80% |
| Mauritania | 4,266,448 | 714,132 | 16.70% |
| Mauritius | 1,281,353 | 803,896 | 62.70% |
| Morocco | 35,241,418 | 20,207,154 | 57.30% |
| Mozambique | 29,537,914 | 1,834,337 | 6.20% |

| | | | |
|---------------------|----------------------|--------------------|---------------|
| Namibia | 2,568,569 | 520,000 | 20.20% |
| Niger | 21,563,607 | 439,164 | 2.00% |
| Nigeria | 191,835,936 | 91,880,032 | 47.90% |
| Rwanda | 12,159,586 | 3,216,080 | 26.40% |
| Sao Tome & Principe | 198,481 | 49,686 | 25.00% |
| Senegal | 16,054,275 | 7,260,000 | 45.20% |
| Seychelles | 97,539 | 56,168 | 57.60% |
| Sierra Leone | 6,732,899 | 310,000 | 4.60% |
| Somalia | 11,391,962 | 660,000 | 5.80% |
| South Africa | 55,436,360 | 28,580,290 | 51.60% |
| South Sudan | 13,096,190 | 2,179,963 | 16.60% |
| Sudan | 42,166,323 | 10,886,813 | 25.80% |
| Swaziland | 1,320,356 | 389,051 | 29.50% |
| Tanzania | 56,877,529 | 7,590,794 | 13.30% |
| Togo | 7,691,915 | 430,482 | 5.60% |
| Tunisia | 11,494,760 | 5,800,000 | 50.50% |
| Uganda | 41,652,938 | 11,924,927 | 28.60% |
| Zambia | 17,237,931 | 3,167,934 | 18.40% |
| Zimbabwe | 16,337,760 | 6,759,032 | 41.40% |
| TOTAL | 1,244,778,450 | 334,926,434 | 26.91% |

Source: Internet World Statistics, <http://www.internetworldstats.com/stats1.htm>

While access to mobile broadband has increased in urban areas, last-mile connectivity remains a challenge. With about half of the population more than 25km from the nearest fiber connection⁶, broadband connection in rural areas remains very low. With over 70 percent of the population living in rural areas, the majority of those who need the Internet the most, such as rural schools, do not have it due to access challenges. The variation in regulation and strong market concentration around a few players also makes the cost of access high. Existing Internet providers tend to have outdated, low quality networks that are not optimally connected to national, regional and international Internet exchanges, or resilient against failures and outages. Other challenges blocking Internet use in education in Africa include:

- Limited literacy and skills that are needed to participate in the Internet economy
- Lack of infrastructure to host and exchange locally available content
- Inadequate supportive infrastructure such as electricity
- High taxes on ICT hardware and software

⁶ See Africabandwidth Maps, http://www.africabandwidthmaps.com/?page_id=27

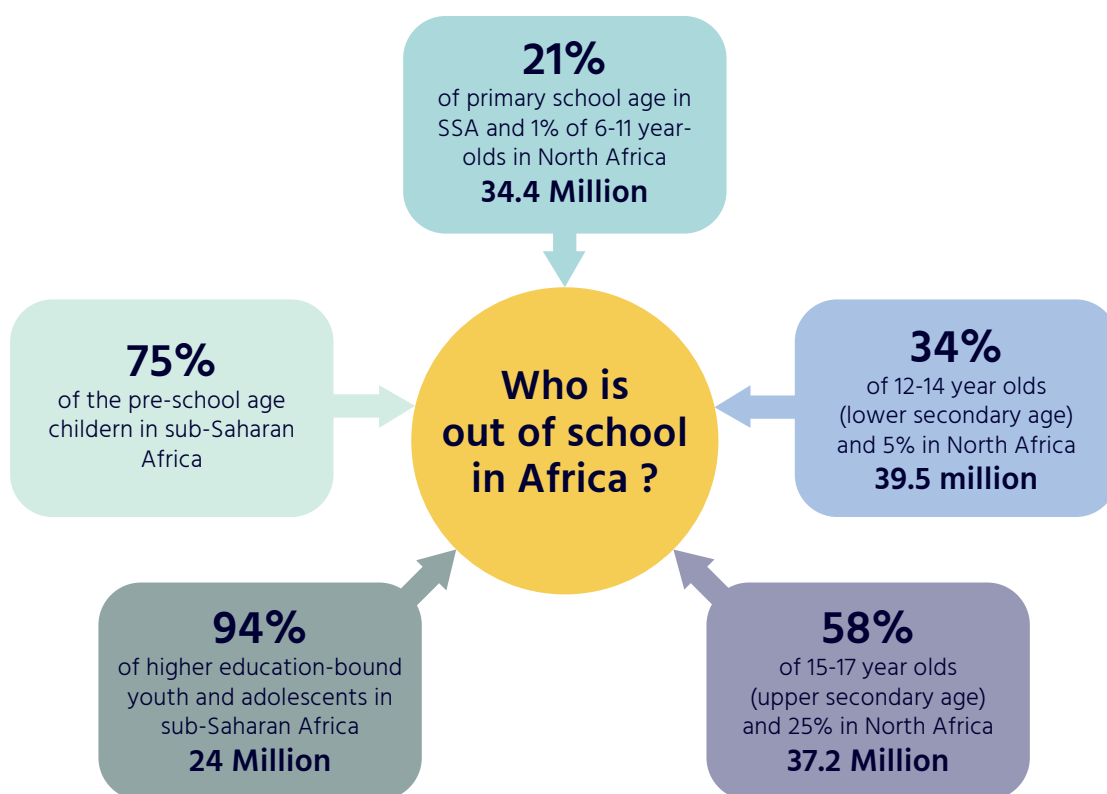
2.1. Challenges to Education in Africa

Education is the basis for knowledge and innovation, and a source of growth, empowerment, peace, security and democracy in the 21st century. Good education provides for better livelihoods, improves health and good family planning. For Africa, a skilled workforce represents one of its main prospects for competitiveness in the global digital economy and for harnessing its natural resources for sustainable growth.

The education and learning process involve diverse people. They include learners, but there are also teachers, school principals, decision makers and parents that play important roles. Learning begins before people enter the school system and continues thereafter; therefore, 1.2 billion Africans can potentially be learners. Learners are also diverse –they are all ages, races, genders and abilities.

Not all learners are in educational establishments. As shown in Figure 1, the majority of Africans, especially those in sub-Saharan Africa are out of school, because they lack access to schools or due to various social and economic circumstances.

Figure 1. Out of School Learners in Africa – in numbers and percentages



Source: UNESCO Institute of Statistics, <http://unesdoc.unesco.org/images/0024/002452/245238E.pdf>

In 2016, the United Nations adopted a 15 years Sustainable Development Goals (SDGs) that include commitments to 'inclusive and equitable quality education and lifelong learning for all'⁷. The education targets of the SDGs, among others, aim to ensure universal pre-primary, primary and secondary education, achieve gender equity among learners, ensure disabled learners attain equal education, and foster youth employability.

The SDG goals on education, which also form the basis of the Education for All (EFA) 2030 Declaration (Incheon Declaration)⁸, also emphasize the importance of vocational and technical training, and quality education.

⁷ United Nations, Sustainable Development Goals, <https://sustainabledevelopment.un.org/?menu=1300>

⁸ United Nations Educational, Scientific and Cultural Organization, Education 2030 Declaration and Framework for Action: Towards inclusive and equitable quality education and lifelong learning for all, <http://www.uis.unesco.org/Education/Documents/incheon-framework-for-action-en.pdf>



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Sustainable Development Goal (Education Targets)

- By 2030, ensure that all children complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.
- By 2030, ensure that all children have access to quality early childhood development, care and pre-primary education so they are ready for primary education.
- By 2030, ensure equal access for all people to affordable and quality technical, vocational and tertiary education, including university.
- By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.
- By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including disabled people, indigenous peoples and children in vulnerable situations.
- By 2030, ensure that all youth and a substantial proportion of adults, of all genders, achieve literacy and numeracy.
- By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including: thorough education for sustainable development and sustainable lifestyles, human rights, gender equity, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.
- By 2030 build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all.
- By 2020, substantially expand globally the number of scholarships available to developing countries, in particular, the least developed countries, small island developing states and African countries, for enrollment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes in developed countries and other developing countries.
- By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially the least developed countries and small island developing states.

The African continent faces the toughest challenges in meeting these international goals, because the education sector confronts far more pressing needs ranging from lack of access to absence of high quality teachers.

These challenges cannot be addressed at the current pace or simply by building more institutions or hiring additional teachers. Public spending on education has been growing in Africa, and policy makers have already been spending a substantial amount of national resources on education. In sub-Saharan Africa, the education budget accounts for about 5 percent of the Gross Domestic Product (GDP), which is second only to North America and Europe at 5.3 percent⁹.

Neither domestic resources nor donor funding are likely to increase rapidly enough over the coming years, therefore policy makers need to devise alternative solutions to improve access to and quality of education. Alternative learning options that harness new technologies must be explored to promote training or learning opportunities on a lifelong basis to all individuals and, more importantly, to those traditionally under-served or marginalized groups (i.e. girls and special needs groups or disabled people).

Pressing Challenges for the African Education System

- **Access to schools:** students are often squeezed into overcrowded classrooms, or classrooms that are falling apart. In some cases, students learn outside. The data from UNESCO shows that in countries like Burkina Faso, Chad, Congo, Mali and Niger have average class sizes with over 50 students per class.¹⁰ The vast majority of these do not have access to toilets, electricity or drinking water.
- **Long distance to school:** for many children around Africa, a walk to school of up to two hours is not uncommon.
- **Nutrition:** millions of children are stunted by hunger. Children often cannot follow lessons because they did not have a meal that day.
- **Expense of schooling:** school fees, uniforms and supplies are burdens to families. Where families cannot afford them, children are forced to stay at home doing chores or work themselves.
- **Conflicts:** armed conflict, both across and within national borders, are prevalent in Africa, with devastating impacts on the livelihoods and education of millions of children and adults.
- **Gender disparity:** more girls are out of school in Africa than boys. 16.7 million girls are out of school in sub-Saharan Africa, 9.3 million of which will never set foot in a classroom.
- **Exclusion due to disability:** a large proportion of the world's 93 million children with disabilities live in Africa, often without the prospect of learning.
- **Quality and quantity of teachers:** more than 7 out of 10 of sub-Saharan African countries do not have enough teachers, especially in mathematics, science and foreign languages. According to UNESCO, sub-Saharan Africa needs 6.2 million teachers by 2030, of which 2.3 million are new positions to be created.
- **Teaching and learning materials:** the absence of quality teaching and learning materials is a key challenge that contributed to the decline of the quality of education in the region.
- **Access to vocational education and technical training:** 37 million out of school youth require some form of technical and vocational education for employment.
- **Access to tertiary education:** Only 6 percent of young people in sub-Saharan Africa are enrolled in higher education institutions compared to the global average of 26 percent.

Source: UNESCO Institute of Statistics <http://www.uis.unesco.org/Education/Documents/africa-regional-education-data-presentation-en.pdf>

9 The Guardian, Education in Africa: Where does the money go?, <https://www.theguardian.com/news/datablog/2011/apr/27/africa-education-spending-aid-data>

10 UNESCO, School and Teaching Resources in sub-Saharan Africa, <http://www.uis.unesco.org/Education/Documents/ib9-regional-education-africa-2012-en-v5.pdf>

2.2. Internet Opportunities for Education

Under the right conditions, the Internet offers an opportunity for addressing the learning needs of diverse groups in Africa, including the bulk of learners that are currently out of school, in a scalable and cost-effective way. A blended learning environment that leverages the Internet can potentially help connect education to work, improve the skills that allow youth to access employment, empower lifelong learners, and importantly, support women, girls and disabled people to participate in learning without space, time and other cultural and social barriers.

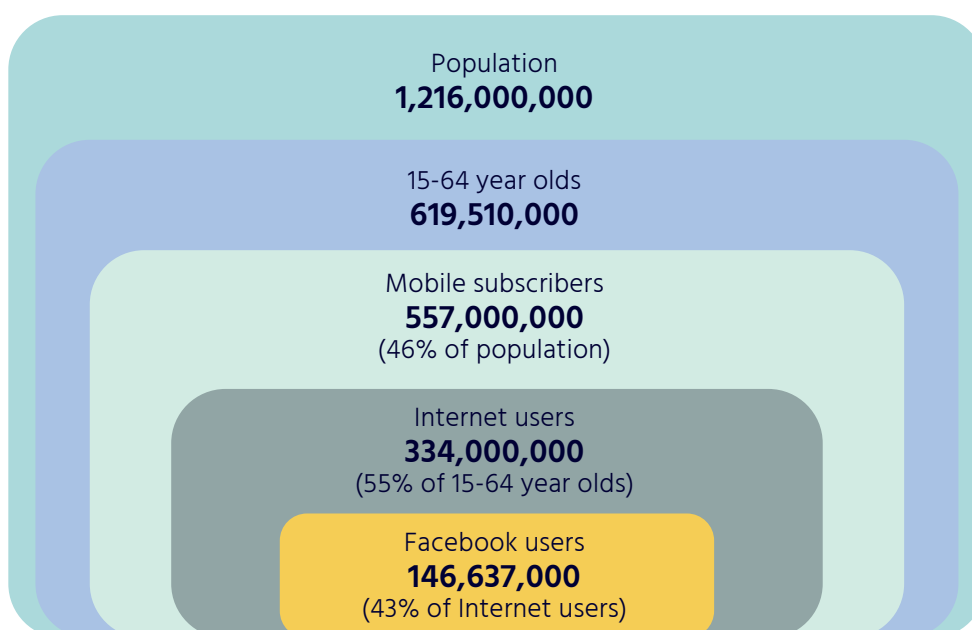
The participation in the global economy is now dependent on 21st-century skills, which includes the ability to navigate in the digital world. Progress in countries like India, China and South Korea shows that connectivity serves as a foundation for access to information economy jobs and advancing innovations.

Why Internet-led learning for Africa?

- The Internet provides for alternative learning tools that contribute to alleviation of the pressing education challenges in Africa from absence of learning materials to limited quality and quantity of teachers.
- The Internet helps to reach more individuals and disseminate content and learning resources, like textbooks, at a lower cost.
- Under the right conditions, the Internet removes the barriers to education that marginalized groups, including women and disabled people, encounter
- Jobs are becoming increasingly global, which needs global connectivity and education that has international relevance.
- There is a demand for greater flexibility in education (any time, any place), by working people that require lifelong learning and on-the-job continuous professional development as employment patterns change. This can be possible via the Internet.

In Africa today, using the Internet for learning is a very real possibility. More than a quarter of the African population (334 million) has access to the Internet, the majority of which is young people and potential lifelong learners¹¹. There were 147 million Facebook users in Africa in June 2016¹² (i.e. 43 percent of Internet users). However, such access to the Internet and heavy use of social media has not been harnessed systematically to advance education and learning at individual and institutional levels.

Figure 2. Mobile, Internet and Facebook Users in Africa



Source: ITU Facts and Figures 2016

<https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf>, www.socialbakers.com/statistics/facebook/

¹¹ International Telecommunications Union, ICT Facts and Figures 2016
<https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf>

¹² <https://www.socialbakers.com/statistics/>

Within the education systems, the Internet opportunities vary across different layers, thus its benefits and approaches accrue to different learners and teachers differently.

Figure 3. Internet for All Levels of Learning



The most obvious benefit of the Internet for all learners is improved convenience. Students can take the classes according to their own schedules. Furthermore, the Internet opens up education in an informal setting, while also improving access to women, girls, those living in underserved rural areas and disabled people. From this standpoint, it contributes to the inclusion, equity, and learning outcome goals of Sustainable Development Goals.

For General Education (Pre-Primary, Primary and Secondary learning), the Internet can help:

- Improve the affordability and availability of textbooks and other learning resources - Internet connectivity can provide access to millions of educational materials that can be updated more regularly than what is possible today with printed products. Textbooks can be accessed over the Internet and downloaded. As they are updated, educational resources can be downloaded to handheld devices for offline reading.
- Provide additional resources to students, helping them to interact with more learning materials and develop their interactive skills.
- Empower, support and enhance the work of teachers engaging with learners in new and more effective ways (including those with special educational needs), in classrooms and outside.
- Enable schools to develop their websites and create platforms for interacting with other schools and nurturing virtual communities.

Within the TVET setting, the Internet:

- Allows students and teachers to access to educational materials, applications and online resources in an open and flexible manner.
- Fosters collaboration between teachers, learners and administrators.
- Allows teachers access to virtual labs and workshops, and helps them to remain up to date with the latest developments in their field.
- Enables learners to be successful in the world of work by promoting interaction with the latest subjects and approaches.

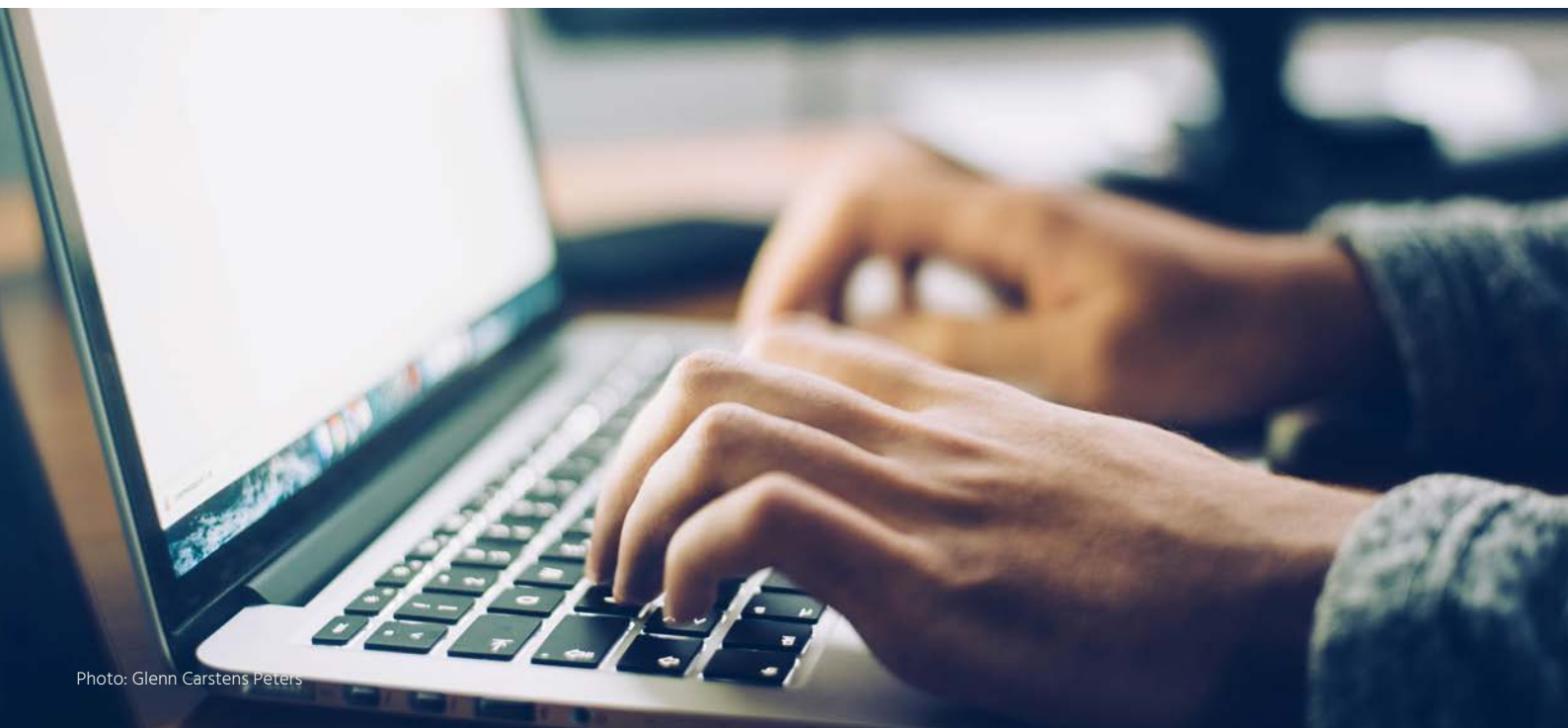
Within the context of higher education, the Internet facilitates:

- The connection of research and educational organizations to each other to foster collaborative research or applications.
- Access to expensive research equipment and laboratories.
- Access to distance learning, video conferencing and specialised services such as Domain Name Services, network security, identity management, network operation, caching, eduroam, eduGAIN and Cloud technology services.
- Access to centralized training, capacity building and advisory services.
- Linkages between the academic and research community, industry, government and other international research and educational networks.
- The sharing of data-intensive applications (e.g. bio-modelling and computation) and sharing of high-end computing assets, facilitating advanced research.
- Access to experimental platforms for researchers to investigate, develop and test new network and Internet technologies, and applications prior to their deployment within the public sector or for commercial use.

For the lifelong, distance or informal learners, the Internet:

- Facilitates learning without time or location constraints.
- Enables a wider array of professional development opportunities for educators and adult learners.
- Allows learners access to global, high-quality education (e.g. MOOCs) that prepare them for global and national employment.

Notwithstanding these opportunities, leveraging of the Internet for education requires a considerable investment in terms of equipment, broadband connectivity, learning resources creation and adaptation, and technical support for both learners and educators. The cost of access to the Internet and securing ICT hardware and software can be high. Even if the hardware and connectivity are available, there are costs associated with maintenance, electricity and content acquisition and/or production. The full buy-in from teachers, and providing professional development to integrate ICTs in teaching, learning and assessment, are also crucial.



3. Experience in Advancing the Use of the Internet for Learning

The last two decades have seen many innovations in education delivered over the Internet. Countries have been making progress in drawing up comprehensive policies for ICT in education, providing students and teachers with the necessary equipment (e.g. one-to-one computing tools like tablets), connecting schools to the Internet and supporting the development of NRENs.

3.1. Country Experiences in Leveraging ICTs and the Internet for Learning in Schools

Argentina, Chile, Costa Rica, India, Macedonia, Peru, Portugal, Singapore, South Korea, Turkey, Uruguay, the United Kingdom, and the United States are among those which have invested considerably in the use of ICTs in schools¹³. Programmes in Africa, Kenya, Mauritius, Morocco, Rwanda, Senegal, Tunisia and South Africa are cited as best practices in expanding access to ICTs in education¹⁴.

Singapore and South Korea are two of the most advanced countries when it comes to the integration of ICT in education. South Korea has rolled out the fastest broadband links to all of its schools. In 2015, all South Korean schools were linked to high speed wireless to allow students to learn “whenever and wherever”, with fully digital textbooks¹⁵. In 2016, the average connection speed in South Korea was 29 Megabits per second (Mbps), way ahead of the other OECD countries¹⁶.

Portugal’s eEscola and Uruguay’s Plan Ceibal projects are two other prominent examples of connecting all schools to the Internet and providing children with free laptops. Uruguay is cited as the first country to embrace one-to-one computing, by introducing and distributing a laptop to every public primary school student as of 2009¹⁷. Other countries including India, Malaysia, Turkey, Denmark, Finland, the Netherlands and Sweden have also made a great progress in connecting schools and blending virtual and face-to-face learning¹⁸.

The lessons from these countries indicate that the full introduction of computers, beginning with the most challenging schools in terms of connectivity and resources, is better than just connecting “league” schools that already have adequate resources and teachers. Another lesson is that one-to-one computing is preferable than “computer labs” that are often locked up. Furthermore, efforts towards the best use of technology for learning requires the development of teachers’ skills to enable them to incorporate ICTs in teaching and the learning process. The best practices also underline the centrality of incentives for teachers, ongoing technical support and the development of content relevant to the local context. Attention should be paid to the development of content in local languages.

13 Michael Trucano, Plan Ceibal: How Students in Uruguay schools are being taught English over the Internet by teachers in Argentina -- and in the UK & the Philippines, <http://blogs.worldbank.org/edutech/category/tags/plan-ceibal>

14 World Bank, Survey of ICT in Education in Africa, <http://documents.worldbank.org/curated/en/642501468194647668/pdf/414750v20REVVIS1Box0327331B01PUBLIC1.pdf>

15 BBC, Digital Text Books Open New Chapter, <http://www.bbc.com/news/business-15175962>

16 <http://www.usatoday.com/story/tech/news/2016/06/30/superfast-internet-south-korea-wins-us-lags-far-behind/86516042/>

17 Anna Prusa and Elizabeth Plotts, 2011, Uruguay’s Plan Ceibal: Can Laptops in the Hands of Primary School Students Reduce the Digital Divide, Improve Education, and Increase Competitiveness? <https://elliott.gwu.edu/sites/elliott.gwu.edu/files/downloads/acad/la/hs/uruguay-potts-prusa-2011.pdf>

18 Joint Research Center, ICT-enabled Innovation for Learning in Europe and Asia, <http://ftp.jrc.es/EURdoc/JRC83503.pdf>

Uruguay's Plan Ceibal has also addressed two of the most difficult challenges facing massive rollout of ICTs in schools – maintenance, and content creation and adaptation. In Uruguay, thousands of volunteers organized themselves to solve the different challenges facing ICT in learning, from technical support to content development. These include Flor de Ceibo, which coordinates the volunteer and research work of students and teachers from the Universidad de la República in support of Plan Ceibal, ceibalJAM!, an independent civil association formed by volunteers to promote the development of free educational software and resources, and RAP Ceibal, a loose network of over 1,000 volunteers who help with technical support¹⁹.

Portuguese eEscola Plan

The Portuguese eEscola plan was part of the national ICT development strategy. The aim was to make computer equipment (portable devices) and broadband Internet (particularly wireless) available to students, teachers, adults in schools, and youth associations²⁰. The core activities of the programme were:

- Providing schools with high-speed broadband Internet and enabling services such as voice, video-conference, TV, and surveillance over IP
- Providing schools with quality web services and content
- Leveraging ICTs for simplification of school management
- Facilitating digital education
- Facilitating education entities with tools to better coordinate, supervise, and control results

Instead of pilot projects, the eEscola program focused on a comprehensive plan for educational 'transformation' to help improve education through the widespread introduction of new technologies, low-cost laptops, broadband connectivity, educational content, and related training and support for teachers. The programme was also aimed at creating a local, sustainable economic model to fuel local job creation in IT industries and expand international trade opportunities²¹. By 2014, over 1.7 million students, teachers and administrators had benefited from the eEscola programme

3.2. Education and Research Networks for Higher Education

Within the higher education segment, efforts for promoting the use of ICTs were coordinated through National Research and Education Networks. While direct access to the Internet provides the link to a vast array of commercially available resources, academic and research institutions need to connect to each other to share learning materials and to access expensive high-end instruments, specialized databases and applications, which are not readily available through commercial connections. NRENs design, build and operate advanced communication networks that deliver access to academic and research resources, applications and the Internet. The creation of NRENs stimulate coordination among national universities that will in turn cut down communication costs and promote scientific collaboration. The NREN model is so successful and necessary that today there are over 120 countries that have initiated NRENs including those in Africa²². Asia, Australia, Europe and North America have some of the most successful NRENs with different governance and funding models, organizational structures, and services.

19 Christoph Derndorfer, OLPC in Uruguay: Impressions of Plan Ceibal's Primary School XO Laptop Saturation <http://edutechdebate.org/olpc-in-south-america/olpc-in-uruguay-impressions-of-plan-ceibal/>

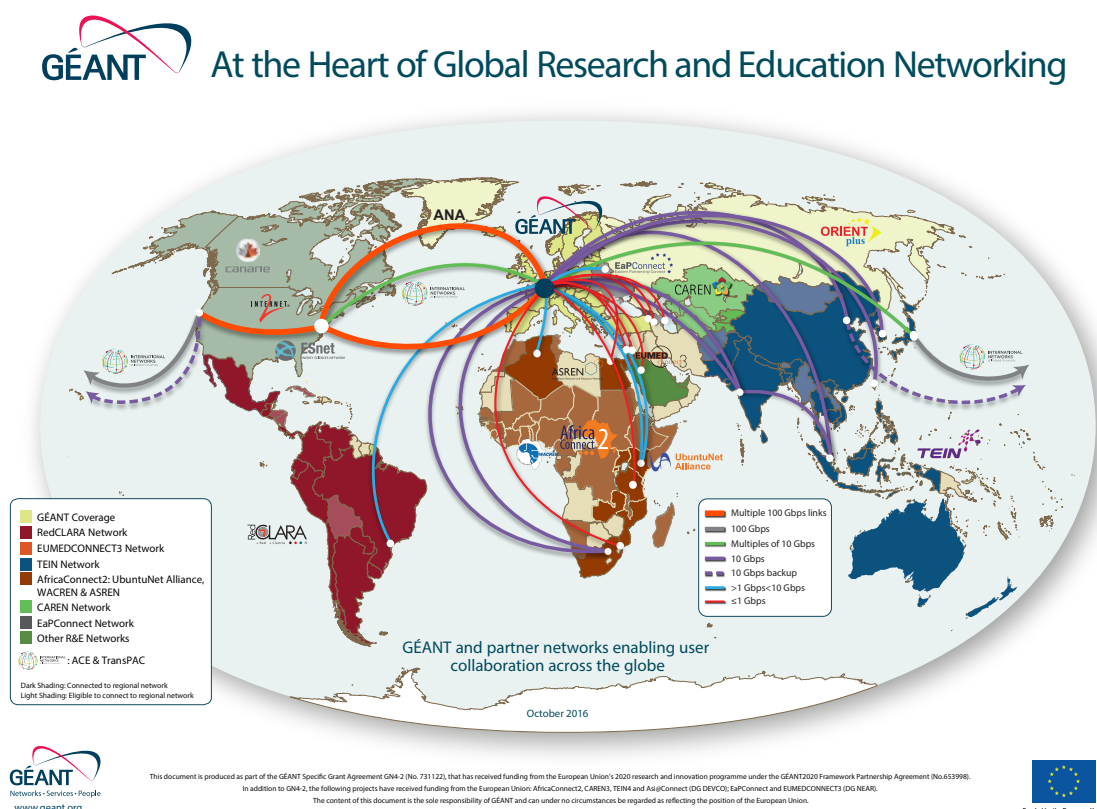
20 Mario Franco, Portugal's eEscola Earns Top Marks, Government's ICT Strategy Increases Competitiveness in Portugal, https://handshake.pppknowledgeab.org/wp-content/uploads/2014/10/hs_connectivity_portugals-eescola-earns-top-marks.pdf

21 Michael Trucano, Around the World with Portugal's eEscola Project and Magellan Initiative, edu tech blog, <http://blogs.worldbank.org/edutech/portugal>

22 <https://www.dfn.de/en/global-co-operations/national/>

The NRENs further coordinate through Regional Research and Education Networks (RREN). Europe features the most paradigmatic example of RREN and the construction and management of an advanced next-generation supra-network (GÉANT), which today is deployed in all countries in Europe. The Asia Pacific Advanced Network (APAN) is another RREN that works towards fostering research and education networking in the Asia-Pacific region. Other regional networks include the Cooperación Latino Americana de Redes Avanzadas (CLARA)²³ a non-governmental association of Latin American National Research and Education Networks. North America is not served by a single organization, but through a collaboration of different research and education networks. Internet 2²⁴ brings together American universities as the University Corporation for Advanced Internet Development in the United States and is the largest such network.

Figure 4. International Research and Education Networks



Source: GÉANT Association,

http://www.geant.org/Resources/PublishingImages/1142%20Global%20Connectivity_october-2016.jpg

As can be seen from the above GÉANT Association map, the formation of Regional RENs is a fairly recent phenomenon in Africa and the Caribbean. The UbuntuNet Alliance (UA) for Research and Education Networking²⁵ is the most advanced Regional REN in Africa. UA was established in 2006 as a response to the need to bring sufficient and affordable bandwidth to eastern and southern African universities. The West and Central African Research and Education Network (WACREN) is another initiative that was established in 2012 to spearhead the development of NRENs and the delivery of advanced high performance connectivity and network services in west and central Africa. Algeria, Djibouti, Egypt, Libya, Mauritania, Morocco, Somalia, Sudan and Tunisia belong to the Arab States Research and Education Network (ASREN), that coordinates academic collaboration in the middle east and North Africa²⁶.

Experience in the formation of research and education networks indicates that academic institutions need the fastest network possible to connect to the Internet and to access advanced research databases and instruments. Collaboration and access to educational content

²³ www.redclara.net

²⁴ www.internet2.org

²⁵ www.ubuntu.net

²⁶ <http://asrenorg.net/>

is also an essential element, because higher education thrives within communities that share resources. While NRENs generally focus on tertiary education institutions, there are situations where they play a key role in interconnecting the entire education system including schools, and Technical and Vocational Education and Training institutions. The Croatian Academic and Research Network (CARNet)²⁷ for example, is responsible for interconnecting all schools and colleges in the country.

3.3. The Open Educational Resources Movement

The Open Educational Resources (OER), OpenCourseWare (OCW) and Massive Open Online Courses (MOOCs) initiatives are the other innovations that have accelerated the use of the Internet in education over the last two decades. In 2001, the Massachusetts Institute of Technology (MIT) launched the OpenCourseWare (OCW) initiative that made its high-quality learning resources freely accessible via the Internet. Since then, there has been increasing interest in Open Educational Resources (OER) – i.e. teaching, learning, and research resources like course materials, textbooks, videos, and software, that are available on the Internet under an intellectual property license and permit their free use or re-purposing by others. There are also online service tools (such as SchoolKeep, Fedora, and Skilljar) that provide guidance to instructors on how to create their own online learning videos to serve diverse and specific learning needs²⁸.

Today, the OER movement spans many regions and countries. OER Africa²⁹, for example, supports individuals and organizations in creating and using OER to enhance teaching and learning. Through proof of concept, pilot projects, action research, toolkits, guides and workshops, OER Africa facilitates interaction, resource sharing and adoption of the OER to meet the requirements of higher education in the region.

There has also been high-profile initiatives that focused on pre-primary, primary and secondary education. Khan Academy³⁰ is one of the most widely used online educational resources worldwide, and offers more than 2,700 video lectures and tutorials, in subjects as diverse as mathematics, finance and cosmology. In addition to videos, the Khan Academy provides students with an option to exercise their knowledge through a web-based system offering problems based on skill level and performance.

Efforts have also been underway to ensure learning resources are available for those without good connectivity. For example, Rachel Offline (<https://rachelloffline.org/collections/rachel>) is a service which packages educational resources for places without the Internet using low-cost computing devices.

In the recent years, much of the public's attention has focused on the use of the Massive Open Online Classes (MOOCs) – and their potential for offering entire courses from well-known universities like MIT, Harvard and Stanford. While the OER focused on materials, which can be mixed and modified, the MOOCs paid more attention to full courses or mini-courses developed and guided by an instructor that are designed for large-scale participation.

MOOCs and OER are generally interrelated. One of the largest major MOOC providers, edX, is the direct outgrowth of MIT's OpenCourseWare initiative. The edX consortium now has many institutions participating including: MIT, Harvard, Berkeley, University of Texas System, Wellesley College, Georgetown, Australian National University, École Polytechnique Fédérale de Lausanne, University of Toronto, RICE, TU Delft, and McGill³¹. MOOCs are different from traditional universities in the sense that anyone can participate in an online course for fee or for free, and courses can be designed to support an indefinite number of participants.

²⁷ <http://www.carnet.hr/>

²⁸ The Atlantic, The Lifetime Learner, <http://www.theatlantic.com/sponsored/deloitte-shifts/the-lifetime-learner/256/>

²⁹ <http://www.oerafrica.org/>

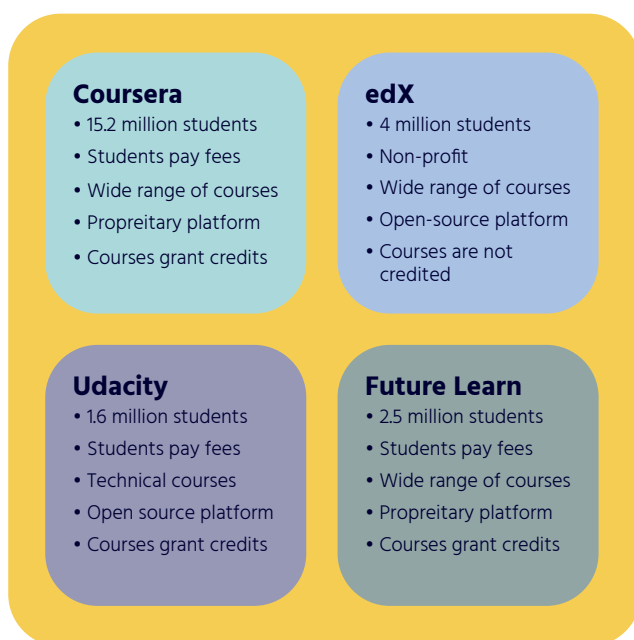
³⁰ <https://www.khanacademy.org/>

³¹ <https://www.edx.org/schools-partners>

The four major MOOCs by number of students are Coursera, Udacity and edX – all based in the United States – and FutureLearn which is located in Europe.

- Coursera³² was founded in 2012 by Stanford academics Daphne Koller and Andrew Ng. It is a for-profit educational enterprise and currently the largest MOOC platform in terms of university partners, courses and student enrolments, with over 3.5 million unique registrations in 2015.
- edX³³, which was incorporated in 2011 as non-profit venture, had over 1 million students in 2015.
- Udacity³⁴ was established by Sebastian Thrun in 2011 following his Stanford class MOOC experiment. It is a for-profit educational enterprise, and works with individual academics as well as technology firms to develop technology and computer science-related courses. It had 400,00 registered users in 2015.
- FutureLearn³⁵ is a MOOC platform of the UK's Open University. It had 2.5 million students in 2015.

Figure 5. Comparison of Top Four MOOCs



Source: Malathi Sriram, Comparative Analysis of Massive Open Online Course (MOOC) Platforms, http://globalbizresearch.org/Kolkata_Conference/docs/KOLKATA/1.%20Global%20Business,%20Economics%20PDF/1.%20Global%20Business,%20Economics%20PDF/K515.pdf

There are also MOOC startups in other countries that aim to compete with the large MOOCs including Open2Study³⁶ in Australia, Iversity³⁷ in Germany, XuetangX in China, Unopar in Brazil, and jMOOC from the Open University of Japan. However, there is limited activity in Africa that benefits from the growing MOOC platforms. Access to MOOCs requires adequate bandwidth to access to videos and other interactive learning materials. Despite these challenges, MOOCs can be successful in the African context, as long as MOOC instructors are able to adapt the content and make use of available and appropriate technologies³⁸.

³² <https://www.coursera.org>

³³ <https://www.edx.org>

³⁴ <https://www.udacity.com>

³⁵ <https://www.futurelearn.com>

³⁶ <https://www.open2study.com>

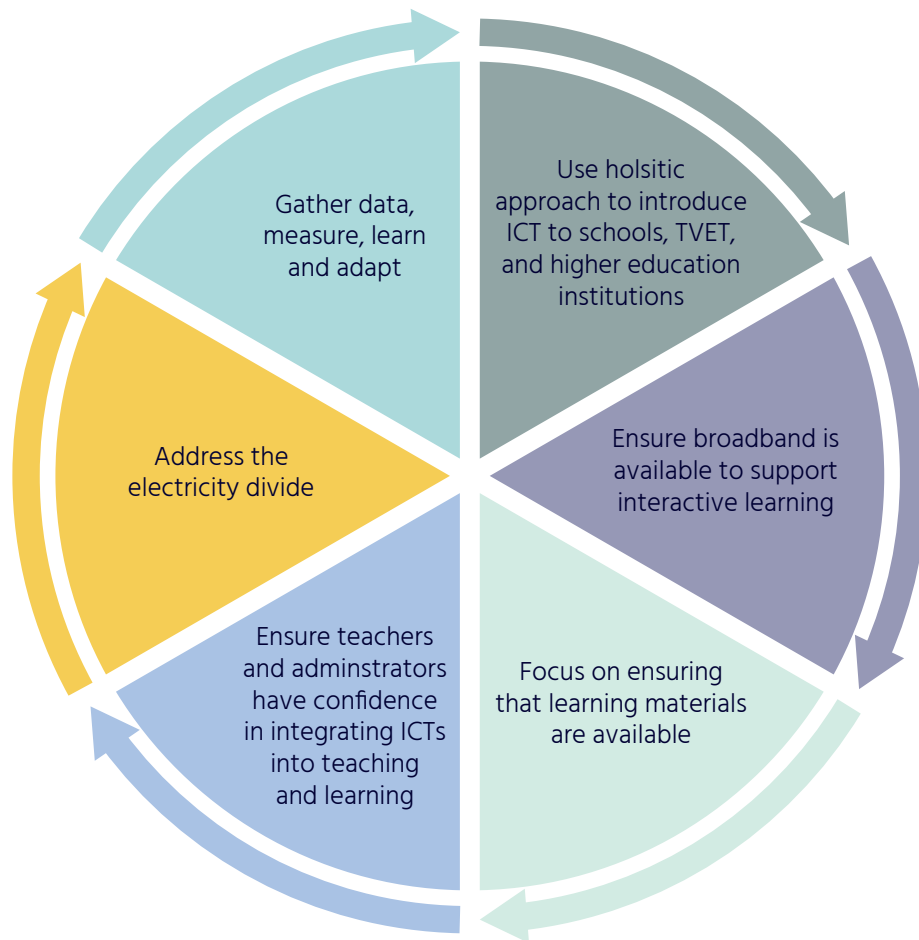
³⁷ <https://www.iversity.org>

³⁸ Commonwealth of Learning and UNESCO, Making Sense of MOOCs, Guides for Policy Makers in Developing Countries <http://unesdoc.unesco.org/images/0024/002451/245122E.pdf>

3.4. Major Lessons from the International Experience

Examining other nations experiences when it comes to developing ICT for education policies and promoting Internet access to schools gives policy makers and others in Africa a wide range of choices. But these experiences underline that these programmes should be tools for learning. The focus should always be on how to use connectivity and tools for enhancing learning outcomes and competitiveness of the region. The growing use of videos and interactive platforms available through MOOCs and OER also means the low-bandwidth environments in most countries in Africa cannot support these interactive (gamified) lessons.

Figure 6. Slices of lessons from Integrating ICTs in Education Worldwide



4. The Context of Internet Use for Education in Africa

Efforts to connect the education sector in Africa to date involved linking schools, and providing universities with support and advice to integrate technology in teaching and the learning process. Many development agencies including the World Bank, UNESCO and the ITU have invested in ICT in schools within the context of school networking (Schoolnet) programmes. The New Partnership for African Development (NEPAD) Schoolnet Africa programme was among those that invested in demonstration programmes in ICT use in schools in coordination with private multinational companies like AMD, Cisco, HP, Microsoft and Oracle. A review of the Schoolnet initiatives indicates that sustainability remains a major issue, especially for those with donor funding. While the access to computers enhanced ICT skills of teachers and students, there is no evidence that the ICT is integrated into the teaching and learning process³⁹.

The Ford Foundation, Carnegie Corporation of New York, the McArthur Foundation, and the Hewlett Foundation have been active in the higher education segment, particularly in advancing connectivity and promoting access to educational resources such as journals. In recent years, there has been an increase in activities connecting higher education institutions in Africa within the context of National Research and Education Networks (NRENs).

It is difficult to assess the impact of ICT investment by donors and governments in Africa. Data on Internet use in education is not readily available, because countries and donors have not invested in systematic data collection on their ICT investment. A survey by UNESCO Institute for Statistics (UIS) in 2014 indicates the ICT integration in education varies considerably across African countries.

The UIS data shows some countries like Kenya, Rwanda and Senegal have embraced one-to-one computing that has increased computer to learner ratios. Mauritius was able to achieve a 23-children-per-computer ratio on average in primary schools and 19-children-per-computer on average in secondary schools in 2014. Rwanda, that was involved with the rollout of One-Laptop-Per Child (OLPC), has achieved a learner-to-computer ratio of 40 to 1 at both secondary and primary levels. At the lower end of the scale, Madagascar had a ratio of 500-students-per-computer in 2014⁴⁰.

The improved broadband connectivity in countries like Botswana, Egypt, Kenya, Morocco, Rwanda, Senegal, South Africa and Tunisia has also increased learners' and teachers' access to the Internet at all educational levels. In other countries, whenever connected, schools had access to narrowband networks that are not suitable for interactive learning. Bandwidth is a scarce resource, with students and teachers occasionally waiting, waiting, and waiting to bring up a single web page. In these countries, the use of the Internet is further constrained by lack of access to electricity.

The UIS survey also found widespread use of computer labs for Internet connections and ICT training. Typically, computers in the labs are locked up due to security, electricity outages and other constraints, thus less used by teachers and students. Data also shows that the significant penetration of mobile phones across the continent has not been tapped into for educational purposes, because of high communications costs, low bandwidth and the absence of locally relevant applications and content for mobile learning.

³⁹ InfoDev, Evaluation of the NEPAD e-schools project <http://documents.worldbank.org/curated/en/208421468140054464/pdf/408800NEPAD0e11b1ic0Report01PUBLIC1.pdf>

⁴⁰ UNESCO Institute of Statistics, Information and Communication Technology (ICT) in Education in sub-Saharan Africa, A comparative analysis of basic e-readiness in schools, <http://www.uis.unesco.org/Communication/Documents/ICT-africa.pdf>

The high price of connection was another factor for under-resourced educational establishments. Broadband prices in Africa have come down recently but they are still high compared to those in Asia and Latin America. Prices of bandwidth are very high especially in landlocked countries, in countries with dominant players, and where the commercial conditions do not allow for long-term Indefeasible Right of Use (IRU) of fibre networks. In West Africa the price of a 1 Mbps circuit has gone down from between US\$3,000 and US\$9,000 in 2008 to between US\$500 and US\$1,800 in 2014. In 2015, the prices were between US\$300 and US\$1,200. These prices are generally high when compared to Asian prices that range between US\$32 to US\$70 per Mbps/month and the prices in Latin America, which range between US\$32 and US\$80 per Mbps/month⁴¹.

So far, the efforts in connecting schools across the region are not inclusive, and access is not available to those who need it the most, like disabled people. The focus on upper secondary schools also means that primary schools and those schools with special needs students were largely untouched in Africa.

The emerging risks for children including consumer-related risks (for example, online fraud and marketing), contact-related risks (such as online predators and cyber bullying) and privacy-related risks (issues related to protection of personal information)⁴² are new in Africa. Child safety data by the Family Online Safety Institute⁴³ explains the approach to date has been to treat this topic largely as a law enforcement issue; with awareness generally at low levels.

The situation in the Technical and Vocational Education and Training institutions is not very much different. In the TVET environment, there is a tendency to treat ICT as a vocation rather than an enabler for learning. As a result, Internet access is often confined to computer labs or libraries of the TVET institutions. With the higher education enrollment rate at only 6 percent in the region, the vast majority of secondary school graduates are unable to find places in the colleges and universities⁴⁴. Therefore the opportunities for harnessing the Internet for on-the job learning, informal learning and distance education is very high.

The higher education segment has a relatively better Internet connection; yet despite significant investments in recent years, the region still lags behind other regions in interconnecting universities and research institutions to increase participation in global collaboration. The interconnection of universities typically involves the formation of a National Research and Education Network, that interconnects local tertiary level institutions and links them up to regional research and education networks.

Where successful, NRENs were able to bring the cost of access down and increase the bandwidth that is available for member academic and research institutions. In eastern and Southern Africa for example, the prices have been falling fast, partly due to the emergence of regional carriers like Liquid Telecom and the effort by champions in negotiating for long-term Indefeasible Right of Use (IRUs) on fibre networks. The European Union's funding of the AfricaConnect programme⁴⁵ for example, was able to provide support to NREN champions in the region to negotiate with providers for reduction of international and regional circuit costs based on favourable Indefeasible Right of Use (IRU) prices. As a consequence, prices have fallen greatly from where they were in 2011 in some countries.

41 <https://blog.cloudflare.com/the-relative-cost-of-bandwidth-around-the-world/>

42 OECD, The Protection of Children Online, Recommendations of the OECD Council
https://www.oecd.org/sti/ieconomy/childrenonline_with_cover.pdf

43 <https://www.fosi.org/>

44 <http://ent.arp.harvard.edu/AfricaHigherEducation/Factoids.html>

45 <http://www.africaconnect.eu/Pages/Home.aspx>

Table 2. Prices of Broadband Connection at Universities in Kenya, Uganda and Zambia

| Country | Price of 1Mbps circuit / month 2011 | Price of 1Mbps circuit / month 2015 | Price of 1Mbps circuit / month 2016 |
|---------|-------------------------------------|-------------------------------------|-------------------------------------|
| Kenya | \$600 | \$160 | \$120 |
| Uganda | \$630 | \$210 | \$180 |
| Zambia | \$1200 | \$380 | \$300 |

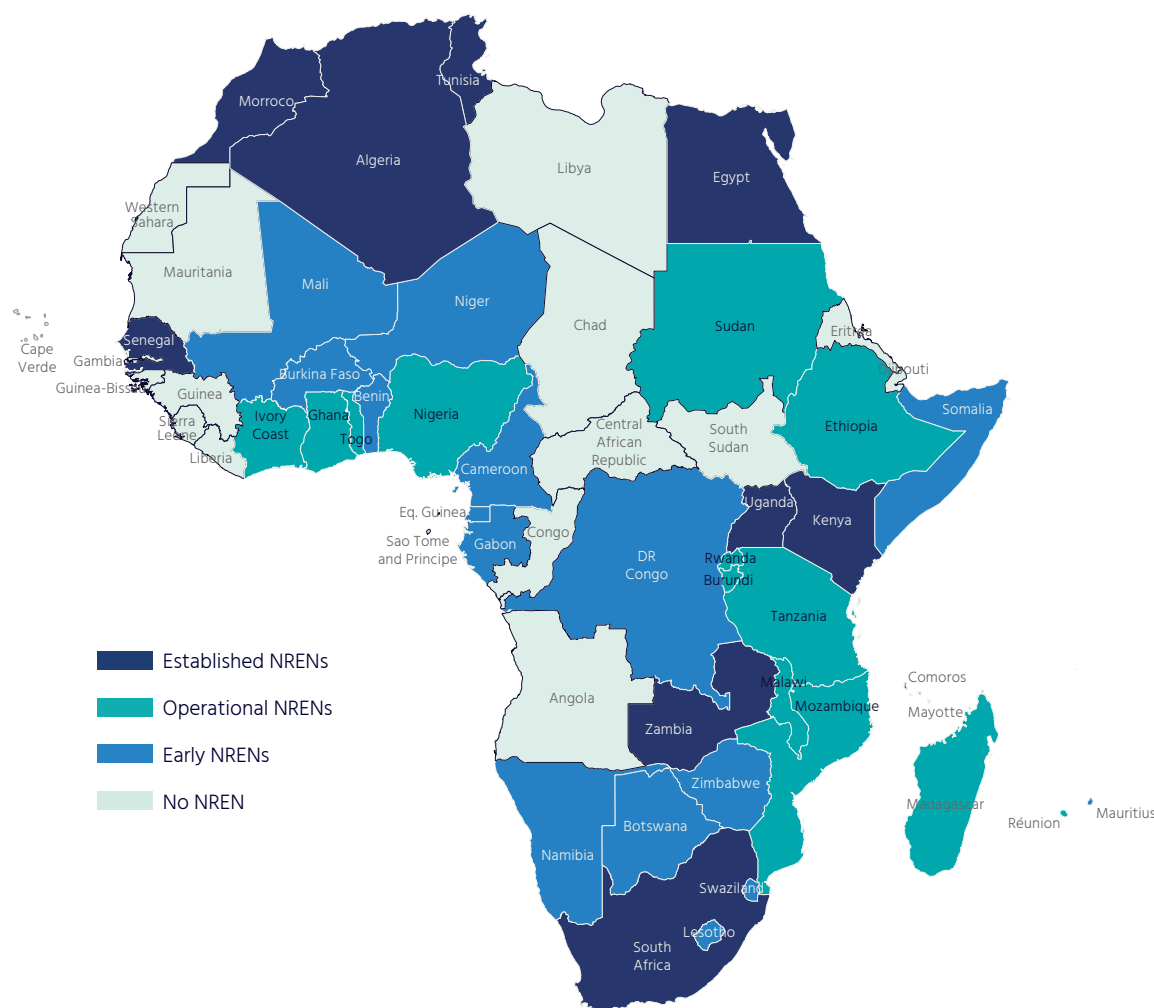
Source: NRENs in Kenya, Uganda and Zambia

However, the formation of NREN institutions and their access to affordable bandwidth varies considerably across Africa. NREN readiness is achieved when sufficient government commitment is secured, and an organization that is recognized and supported by the public and private higher education institutions is created. The organization needs to be properly staffed to handle both administrative and technical matters, and to have the capacity to negotiate connectivity deals on behalf of their members. A review of the Association of African Universities (AAU) that draws on the NREN Maturity Model developed by Duncan Greeves⁴⁶ groups the African countries in one of the following four NREN categories:

- **Matured NRENs** - Nine countries have achieved significant progress in terms of interconnecting universities and research institutions by 2016. The countries in this category are Algeria, Egypt, Kenya, Morocco, Senegal, Tunisia, South Africa, Uganda and Zambia. Uganda and Zambia have seen progress over the last two years due to investment by local champions and favourable regulatory environments.
- **Connecting NRENs** - The second category represents countries that have established physical networks among their universities and research institutions, and have made links to international networks a priority. These include Cote d'Ivoire, Ethiopia, Ghana, Madagascar, Mozambique, Nigeria, Rwanda, Sudan, Tanzania and Togo.
- **Starting NRENs** - The third group represents countries which initiated NREN activities, but have not yet built robust physical networks between academic institutions. Benin, Botswana, Burkina Faso, Burundi, Cameroon, Democratic Republic of Congo, Gabon, Lesotho, Malawi, Mali, Mauritius, Namibia, Niger, Swaziland, Somalia and Zimbabwe have activities on the ground that will lead to NREN formation, but these efforts lag far behind in terms of establishing viable networks among their tertiary level institutions.
- **No Activity** - The fourth category comprises countries that do not have NREN activities on the ground. They are: Angola, Cape Verde, Central African Republic, Chad, Comoros, Republic of Congo, Djibouti, Equatorial Guinea, Eritrea, Gambia, Guinea, Guinea-Bissau, Liberia, Libya, Mauritania, Sierra Leone, Sao Tome and Principe, Seychelles, and South Sudan.

⁴⁶ Greeves, Duncan, NREN Capability Maturity Model, http://www.ubuntunet.net/sites/ubuntunet.net/files/NREN_Capability_Maturity.pdf

Figure 7. NREN Maturity in Africa



Source: Association of African Universities

As illustrated in Figure 8, the most successful NRENs are in Algeria, Egypt, Kenya, Morocco, Senegal, South Africa, Uganda and Zambia. These have benefited greatly from government direct funding or from financial support provided by regulators. Kenya, Senegal, South Africa, and Zambia have also benefited from donor funding at the start of their National Research and Education Networks processes. Significant funding has also been available from the European Commission to develop regional networks and interconnect NRENs to each other and to European Research Network GÉANT through the AfricaConnect and EUMEDCONNECT projects. The World Bank has also been providing support to selected NRENs in their effort to expand connectivity nationwide and to link up to global networks.

While access to connectivity (Internet) has been the primary focus of African NRENs, there is a growing urge for mature NRENs to pay particular attention to content, applications and collaboration. Consequently, NRENs like KENET (Kenya), TENET (South Africa), RENU (Uganda) and ZAMREN (Zambia) have begun looking into the application and content area by launching services such as eduroam, identity management, hosting of Google caches and mounting digital library services that encourages improved global research collaboration; but the work in this area is just beginning in many other countries.

In summary, it is evident from the UIS data and the NREN formation in Africa that progress in promoting affordable access to the Internet at all levels of education has been slow, and efforts in providing teacher training and content adapted to local settings are negligible. Other core challenges include limited access to electricity and lack of financial resources to rollout ICT in education projects.

Figure 8. Traffic Lights for Factors Constraining ICT in Education in Africa

| Level | Internet and broadband connectivity | Teacher training and incentives | Educational resources and content | Cost of access to ICTs | Electricity | Financial resources |
|--|-------------------------------------|---------------------------------|-----------------------------------|------------------------|-------------|---------------------|
| Pre-primary and primary | ● | ● | ● | ● | ● | ● |
| Secondary | ● | ● | ● | ● | ● | ● |
| TVET | ● | ● | ● | ● | ● | ● |
| Higher Education | ● | ● | ● | ● | ● | ● |
| Lifelong Learning (on the job, informal, etc.) | ● | ● | ● | ● | ● | ● |

The lights are generally red because governments have not been active in terms of drafting clear, holistic policies and well-communicated strategies and plans to advance the Internet ecosystem. The efforts towards gender equity, inclusive access for disabled people and those addressing online child safety are also very low. Efforts are underway in all countries in collecting Educational Management Information Systems data, but this has not been used effectively to monitor the progress of ICT in education and to learn from past experience.

Figure 9. Traffic Lights of Other Factors Constraining ICT Use in Education in Africa

| Level | Holistic vision and policy | Data and Educational Management Information System | Research and Learning in use of ICT for learning | Capacity for large scale project management and maintenance | Inclusion (gender equity and access for disabled people) | Safety and privacy |
|--|----------------------------|--|--|---|--|--------------------|
| Pre-primary and primary | ● | ● | ● | ● | ● | ● |
| Secondary | ● | ● | ● | ● | ● | ● |
| TVET | ● | ● | ● | ● | ● | ● |
| Higher Education | ● | ● | ● | ● | ● | ● |
| Lifelong Learning (on the job, informal, etc.) | ● | ● | ● | ● | ● | ● |

Policy makers have a crucial role in addressing these red flags by developing holistic, open and inclusive policies for the integration of ICTs in the education system and beyond (e.g. facilitating lifelong learning).

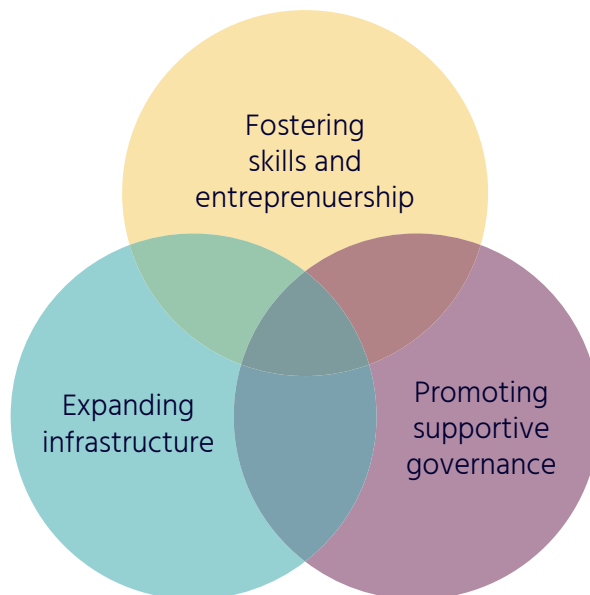


5. Role of Policy Makers in Addressing the Constraints

5.1. Policy Making

The experience in successful countries suggest that broadband and computers should be available to all learners. At the same time, countries need to strive to make the best use of the available network and computing resources. For this to happen, policy makers need to carry out three interrelated activities that are outlined in the Internet Society Framework for Enabling Access, namely: expanding infrastructure, fostering skills and entrepreneurship, and promoting supportive governance.

Figure 10. Internet Society Enabling Environment Framework



Source: <http://www.internetsociety.org/doc/policy-framework-enabling-internet-access>

- Policy makers need to remove the barriers to investment by creating transparent and affordable licensing, and efficient market-based spectrum allocation processes. There is also a need for promotion of infrastructure sharing, simplified right of way approval, and dig-once policies and processes. Policy makers also need to encourage community-based access initiatives and educational networks.
- Decision makers need to support human capacity development at all levels, facilitate local innovations through innovation hubs and promote community-driven peering interconnection and IXP discussions.
- Policy makers need to develop well-articulated policies and plans, and ensure that these are implemented through multistakeholder partnerships.

In the education sector, decision makers need to articulate clear and holistic visions on ICT in education that cover the entire spectrum of learning from pre-school to primary and secondary schools, TVET, colleges and lifelong learning. The ICT in education policy and vision should keep an eye not only on access but also on learning outcomes and equity. Policy makers in the education sector should embrace multistakeholder partnerships by working with their counterparts in the communications sector and other stakeholders.

5.2. Infrastructure for Learners

The effort to bring Internet access to schools, colleges and universities will not succeed without a good broadband connection. While a basic connection to the Internet can be helpful at the beginning, the real benefit of blended learning cannot be realized without access to a high bandwidth link (at least 10 Mbps link to schools). Since the demand for bandwidth increases with use, efforts should be made to provide schools with adequate bandwidth to enable them to load videos without interruption and waiting.

This indicates that African policy makers should strive to accelerate the rollout of broadband networks either by creating conducive regulatory environments that allows private sector investment in high capacity fiber and wireless infrastructure or forging public and private partnerships to extend broadband connectivity to remote and underserved areas. Policy makers should also strive towards reducing spectrum fees for educational networks and lowering taxes on devices such as computers, smart phones and tablets to facilitate one-to-one computing.

The electricity divide is another bottleneck that needs to be addressed through ICT in education policy. Efforts to develop the learning infrastructure should therefore include expansion of grids or alternative sources of energy to schools and colleges.

Governments should also develop new school building codes that help create modern institutions, making blended learning a reality. The physical and architectural design of new educational institutions should also take the need for interactive classrooms of the future into consideration. Schools and colleges should have Internet and wireless networks, electric and fiber outlets, and learning spaces integrated into their designs.

In this regard, policy makers can learn from experiences in European countries where school buildings have been moving away from the traditional “small conference room model” to interactive digital classrooms, equipped with tools that facilitate blended learning. A typical digital classroom includes interactive whiteboards, video conferencing equipment, one-to-one tablets, applications and learning content, mobile carts for charging devices, cameras, headsets and speakers as well as printers connected to cloud-based solutions.

Core themes¹ of ICT in education policy

- Holistic vision
- Infrastructure
- Teachers professional development
- Capacity building for decision makers, college and school leaders
- Learning resources, content and applications
- Technical vocational education, skills and youth employment
- Stimulation of national research and education networks
- Equity and inclusion
- Safety, privacy and child protection in online environments
- Data collection (EMIS)
- Monitoring, evaluation, research and learning

¹ Adapted from Michael Trucano, Key Themes in National Education Technology Policies, <http://blogs.worldbank.org/edutech/key-themes-national-educational-technology-policies>

5.3. Teacher Professional Development

Teacher professional development should be an important area of policy focus, because teachers still remain the primary agents of ICT integration into education in Africa. ICT can serve teachers to facilitate better learning and also help them to build their capacities. There are three different ways to deliver professional development for teachers⁴⁷.

- Pre-service training –integrating technology into the teacher training courses to enable teacher and educators.
- In-service training –as a way to reinforce the training offered at pre-service level, or for new induction of serving teachers who did not receive this in initial teacher training
- Sustained formal and informal pedagogical and technical support for teachers using technology

To facilitate teacher training, policy makers can use the UNESCO ICT Competency Framework⁴⁸ for teachers as a starting point. The framework advocates for awareness of ICTs, how to integrate it in education, how to use it in curriculum and assessment, and how to manage and guide students.

Table 3. UNESCO ICT Competency Framework

| | Technology Literacy | Knowledge Deepening | Knowledge Creation |
|--|----------------------|-------------------------|--------------------------|
| Understanding ICT in Education | Policy awareness | Policy understanding | Policy innovation |
| Curriculum and Assessment | Basic knowledge | Knowledge application | Knowledge society skills |
| Pedagogy | Integrate technology | Complex problem solving | Self -management |
| ICT | Basic tools | Complex tools | Pervasive tools |
| Organization and administration | Standard classroom | Collaborative groups | Learning organizations |
| Teacher Professional Learning | Digital literacy | Manage and guide | Teacher as model learner |

Source: <http://unesdoc.unesco.org/images/0021/002134/213475e.pdf>

5.4. Capacity Building for Policy Makers, College Leaders and School Principals

Success in using technology for learning depends on the perceptions of policy makers, school administrators and supervisors. The understanding of these key actors is an important factor in differentiating between fact and fiction about ICT in education, and understanding not only the opportunities, but also the challenges. The articulation of requirements, and the development and implementation of ICT policy in education demands an understanding of the implication of technologies, trends and their impact on learning outcomes by these actors.

Capacity building for policy makers, and school and college leaders, also helps to reduce the barrier of information asymmetry between those who sell the technology, products and solutions, and those who spend resources and implement projects. Technology understanding

⁴⁷ World Bank, African Development Bank and African Union, The Transformation Use of Information and Communication Technologies in Africa, <http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1346223280837/MainReport.pdf>

⁴⁸ UNESCO, ICT Competency Framework for Teachers, <http://unesdoc.unesco.org/images/0021/002134/213475e.pdf>

can have a positive influence on funding and purchasing decisions about educational and information technology resources in schools and universities.

School leadership and the general school environment are critical for full integration of ICT in education, therefore the training and awareness should begin there. Ongoing workshops need to be conducted in a multitude of formats for different decision makers, centrally at the level of the ministry of education, higher education or science and technology ministries, but also at regional and district levels. The capacity building initiatives need to be enhanced with site visits to successful experiences in the home country and abroad, to learn from those who actually experienced the implementation.

A south-south cooperation and coordination, between countries in Asia, Latin America, the Caribbean and Africa that have addressed similar challenges will help greatly to fast track the awareness and capacity building of policy makers and implementers. Experiences in Peru and Uruguay, and initiatives in Kenya, Rwanda, Senegal and South Africa indicate a great deal of potential for south-south learning and experience sharing.

In order to ensure sustainability of the capacity building efforts, policy makers need to establish centers of educational technologies at the level of the ministries that oversee ICT integration in education. University and college leaders should also establish centers of educational technologies that enable them to integrate ICT in the teaching and learning process, and facilitate collaboration with their peers.

5.5. Stimulating Educational Resources

Access to educational resources is an important policy issue, especially within the context of making textbooks and other resources available for students and teachers. There are numerous benefits to using OER. This includes increased access to educational content, lowered costs, increased efficiency in the development of materials and opportunities to re-examine the curriculum based on international practices.

The first step to provision of learning resources over the Internet is to make national textbooks available on a designated website in digital formats. In addition, there is a need to ensure other open educational resources are available for students and teachers through a central repository or multi-disciplinary web portals. Efforts should also be made to avail teachers with tools to reuse, revise, remix and redistribute the content that is available under open licenses.

The effective use of online educational resources needs robust/reliable Internet connection, familiarity with the OER model and help building the capacity of educators to source and adapt OER to their local settings. Thus, policy makers and educational stakeholders should ensure that teachers see the value of sharing and open licensing content for the public good.

While adaptation of educational content is important, more effort needs to be put into the creation of content in local languages. This demands a wide array of efforts including standardization around scripting language,

Paris OER Declaration

The UNESCO-sponsored Paris OER Declaration of 2012 recommends that nations commit to the following:

- Foster awareness and use of OER.
- Facilitate enabling environments for use of Information and Communications Technologies (ICT).
- Reinforce the development of strategies and policies on OER.
- Promote the understanding and use of open licensing frameworks.
- Support capacity building for the sustainable development of quality learning materials.
- Foster strategic alliances for OER.
- Encourage the development and adaptation of OER in a variety of languages and cultural contexts.
- Encourage research on OER.
- Facilitate finding, retrieving, and sharing of OER.
- Encourage the open licensing of educational materials produced with public funds.

common file formats, standardized keyboard and fonts, Optical Character Recognition, and speech to text and text to speech applications in local languages. In addition, there is a need for training teachers in the organization of content in local languages and the production of local MOOCs, as well as making these available in multilingual websites.

For this to happen, policy makers and leading educational stakeholders need to participate in international and regional efforts to make learning and educational materials available to students and teachers; especially those supporting the principle that the products of publicly funded work should carry open licenses. Ministries of education need to join the global OER movement in order to implement the principles contained in the World Open Educational Resources (OER) Congress declaration (Paris declaration)⁴⁹ that advocates for the development, sharing and adaptation of OER to different languages and contexts.

5.6. Jobs and ICT within the context of TVET

From a policy perspective, the use of the Internet for education should also be an enabler not only for learning but also for future employment. Information technology skills are critical for employability in the 21st century. ICT training provides one of the promising platforms for addressing youth employment in Africa. This calls for training in ICT to meet global standards and to provide ICT education that tracks technological advancements and market needs.

The full integration of ICTs in the teaching and learning process in TVET and higher learning institutions demands access to the latest computer science, information technology and networking courses available from reputable universities through MOOCs. Efforts therefore need to be stepped up to provide training for teachers in higher education and TVET institutions to facilitate a blended learning environment by integrating MOOCs and OER in their offerings, especially in the fast-moving computer, network and software engineering fields.

5.7. Stimulating NREN Development

Access to bandwidth is the core challenge to National Research and Education Networks in Africa. The bandwidth challenge is often exacerbated by limited access to last mile fibre networks, limited options for cross-border interconnection to other research and education networks, and the tendency to assume a small amount of bandwidth (1 to 5 Mbps) is sufficient to carry out teaching, research and learning in a modern university. As discussed above, bandwidth prices remain the constraint especially in landlocked countries.

Universities and research institutions also need to redesign and optimize their campus networks in order to integrate them into national and global networks. The improvement of the campus networks for optimal bandwidth management requires considerable training, financial resources, and acquiring state-of-the-art equipment and skills.

Policy makers therefore need to stimulate NRENS by supporting their legal recognition as service providers for closed user groups (i.e. research and education establishments), promoting access to broadband infrastructure, and ensuring their budgets are allocated centrally. Regulators can also play an important role in ensuring that NRENS and schools have access to high bandwidth under favourable commercial conditions, by providing them with preferential treatment for accessing the radio frequency spectrum, and allocating NREN and school connectivity funds from their universal service funds.

5.8. Inclusion and Equity

The Internet is potentially an inclusive technology. Although the gender gap in education and ICTs is reducing in some countries that have made progress in other social economic areas,

⁴⁹ UNESCO, Paris OER Declaration, http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CI/CI/pdf/Events/Paris%20OER%20Declaration_01.pdf

the proportion of girls accessing education and the Internet is low for most countries in Africa⁵⁰. The proportion of out of school girls is higher than boys, and women and girls do not have equitable access to the Internet, which in itself hinders their participation in interactive education. To address the gender imbalance, it is important that policy makers integrate gender dimensions into the ICT in education policies, take concerted efforts in promoting Internet access to women and girls, and stimulate ICT skills development for women.

One billion people are estimated by the World Health Organisation to have a disability, with 80% living in developing countries⁵¹. The United Nations Convention on the Rights of Persons with Disabilities advocates for access to ICT to enable disabled people to participate more fully in all aspects of life. The Internet has a great potential to facilitate the learning of persons with disabilities. Policy makers should therefore step up the efforts to support the design, development, production of affordable ICT tools, applications and learning resources that help disabled people to learn via the Internet equitably.

5.9. Digital Safety, Privacy and Child Protection

The increased use of the Internet for learning will have a down side, especially when access to the Internet occurs outside of homes or schools. The access to the Internet without some form of supervision and guidance can expose children to various risks such as online fraud, cyber bullying, pornography, sexual exploitation and unauthorized access to their personal information. In some countries, children have become victims of ‘cyber addiction’ mainly as a result of overuse of technology for gaming and social interaction⁵².

Cyberbullying is becoming more pervasive in developed countries, and data breaches are also on the rise⁵³. In some situations, this has resulted in loss of life and catastrophic outcomes for families and children.

From a policy perspective, it is important to understand the various risks that students are exposed to when accessing the Internet for learning. Schools are well placed to help children to identify and evaluate the various types of risks they may face when going online, and how to deal with them. The inclusion of important topics like digital citizenship and cyber-safety in the curriculum can help reduce the risks.

Legislative frameworks that address the online risks, such as anti-child pornography laws, can also help mitigate digital safety issues. Stronger law enforcement, including increased cross-border cooperation, is also a typical element in the strategy mix in online child protection.

The Internet Society Trust Framework provides a comprehensive and useful approach towards crafting policies and actions for addressing these issues of safety, privacy and child protection in online environments. The framework suggests approaching trust challenges by building users’ trust, which requires “putting in place the right infrastructure (trusted networks), empowering users to protect their activities (technologies for trust), setting the right policies, and providing a responsive environment that properly addresses users’ well-founded concerns (trustworthy ecosystem).”⁵⁴

To facilitate a quick response on digital safety issues, policy makers need to establish Computer Emergency Response Teams (CERTs) or Computer Security Incident Response Teams (CSIRTs) and coordinate with other countries.

50 Broadband Commission, Doubling Digital Opportunities, Enhancing the Inclusion of Women and Girls in the Information Society, <http://www.broadbandcommission.org/documents/working-groups/bb-doubling-digital-2013.pdf>

51 Internet Society, Internet Accessibility: Internet use by persons with disabilities: Moving Forward, <http://www.internetsociety.org/doc/internet-accessibility-internet-use-persons-disabilities-moving-forward>

52 Uddin, Sabah, et al (2016), Internet Addiction Disorder and Its Pathogenicity to Psychological Distress and Depression among University Students: A Cross-Sectional Pilot Study in Bangladesh, http://file.scirp.org/pdf/PSYCH_2016071517015681.pdf

53 Internet Society, Global Internet Report 2016, https://www.internetsociety.org/globalinternetreport/2016/wp-content/uploads/2016/11/ISOC_GIR_2016-v1.pdf

54 Internet Society, A policy framework for an open and trusted Internet, <https://www.internetsociety.org/doc/policy-framework-open-and-trusted-internet>

Internet Society Policy Principles to Support User Trust

Human Rights: Human rights considerations should be integrated into Internet policies as they are developed, not added as an afterthought. Individuals' rights must be protected on the Internet.

Communications confidentiality: Internet policies should support the principle that Internet users should have the ability to communicate confidentially online. They should also encourage innovation and the use of tools to facilitate confidential communications (e.g. encryption).

Privacy: Individuals' privacy rights and expectations should be protected on the Internet, irrespective of nationality or residence. There should be no pervasive surveillance of Internet communications. Individuals should have the ability to communicate anonymously or pseudonymously.

Consumer protection: Consumers' rights should be respected across the Internet. Governments should support consumer trust by enacting and enforcing consumer protection laws for business conducted in their territory or under their control. They should also engage in international cooperation across borders to ensure consumers' rights are protected no matter where they reside.

Control over data: Internet users should be empowered to exercise control over their data. They should have the ability to take their data from one service to another.

Transparency in policymaking: Governments should be open and transparent about their decisions, policies, laws and practices. They should actively involve stakeholders in Internet policy development.

Legal certainty: Governments should ensure that laws are clear, easy to understand and accessible to all. They should refrain from exercising lawmaking and enforcement powers capriciously or arbitrarily.

Enforcement and remedies: Governments should ensure regulatory authorities have the necessary resources and independence to provide effective law enforcement and remedies for Internet users who have suffered loss, damage or other forms of harm.

Non-discrimination: Governments should ensure their laws and policies prevent the use of the Internet as a means to discriminate against an individual, based on the group, class or category to which that person or thing is perceived to belong to; or based on data profiling.

Watchdogs and whistle-blowers: All stakeholders should recognize and support the value that watchdog organizations and individual whistle-blowers provide to society.

Addressing Digital Safety in Mauritius⁵⁵

In 2009, the Government of Mauritius established a Child Safety Online Committee that drew from the police force, public sector and the Internet community. The first task of the committee was to develop an action plan for addressing online child safety in the country. The action plan that was released by the committee covers the following elements:

- Public awareness campaign (organization of Safer Internet Day; child safety online programmes on TV and radio; logo drawing competition; awareness sessions for schools, women and community centers; website, etc.)
- Safety measures for schools and public Internet access points (including IT security policies, filtering tools and codes of conduct for schools; mandating “appropriate technology to deny access to inappropriate websites” for public Internet access points and cyber cafés)
- Best Practices for ISPs (encourage ISPs to provide filtering tools; codes of conduct for voluntary compliance)
- Legislation to improve child online safety (based on the Model Legislation developed by the International Center for Missing and Exploited Children)
- Enforcement and reporting measures (sensitization of the public regarding reporting mechanisms, creation of a cyber patrol)
- International cooperation (Interpol; ratification of the UN Optional Protocol)
- Monitoring of the Action Plan (creation of a special committee with monitoring and reporting obligations)

As the case of Mauritius shows, addressing digital safety requires concerted efforts by different stakeholders combining infrastructure, policies, technologies, people and action.

5.10. Data and Education Management Information Systems

The efforts listed above need data to monitor the effectiveness of ICT integration in education. Almost all countries in Africa gather data on schools, teachers, students, assessment results and other resources that is often hosted by an Education Management Information System (EMIS). In most countries, EMIS is used to produce a “state of education report” on an annual basis. While educational statistics are critical, their value must go beyond annual reports.

The integration of ICTs in schools, universities and research institutions demands a new set of data on connectivity (access to Internet, devices, electricity), most common Internet navigators, operating systems used, top websites accessed by learners, teachers’ capacity building and ICT integration, content and learning resources, extent of integrations and impact on learning process, and more. Such data should be gathered on a sustainable schedule using a variety of techniques. Part of the data can be gathered by integrating ICT indicators in the routine EMIS data collection process.

ICT can also generate data that can be used to continuously improve the educational system at all levels, for example through usage logs or data capture by teachers, students and administrators at the source. The widespread use of mobile phones, tablets, wireless technologies and social media provide another potential source for data-gathering and uploading at school level. Geographic and other visual elements can be added to the data to

⁵⁵ Berkman Center for Internet Society, Working Towards a Deeper Understanding of Digital Safety for Children and Young People in Developing Nations, http://cyber.harvard.edu/sites/cyber.harvard.edu/files/Gasser_Maclay_Palfrey_Digital_Safety_Developing_Nations_Jun2010.pdf

illustrate progress and help to address particular issues pertinent to different schools. The experience of Check My School⁵⁶ in the Philippines indicates that social media can actually provide data supported with photos and other visual information providing a powerful tool for improving the quality of ICT access and other educational services in schools.

5.11. Monitoring, Evaluation, Research and Learning

Once the data is available, countries need to create capacities and centers of excellence to carry out research on ICT use in education. The data and research will enable evidence-based decision making in the education sector, offer a basis for monitoring global practices and ensure that investment in education technology remains a worthwhile effort.



Photo: Ryan McGuire

⁵⁶ <http://www.checkmyschool.org/?s=>

6. Conclusion

The Internet Society's goal is to promote Internet access to everyone, everywhere. Through a wide range of stakeholders, Internet Society promotes not only Internet standards but also its development as a platform for innovation, economic development, and social progress. Backed by more than 80,000 members and supporters, more than 120 Chapters around the world, as well as more than 143 Organization members, the Internet Society continues to drive the Internet as an open platform for connecting people worldwide and contributes to social, economic, and educational needs.

The Internet presents a wide range of opportunities for people around the world, especially those in developing countries. It serves as a platform for economic and social development, and educational needs. But, the interaction between education and the Internet is far from a reality in the developing world, especially in Africa. Growing mobile and Internet penetration, improved access to international networks, and an increase in national backbone networks in recent years promises more opportunities for technology-powered learning to help African efforts towards meeting the Sustainable Development Goals for education and the Education for All 2030 targets. At the same time, the continent faces a wide range of challenges – from high communications costs, to limited infrastructure in rural and underserved areas, where most of the population lives.

The full integration of ICTs and the use of the Internet for education requires clear vision and policies. Internet Society has developed an Internet Enabling Environment Framework⁵⁷ that provides overall guidance for addressing policy challenges in developing countries. The Framework highlights the necessity of encouraging infrastructure investment, fostering skills and entrepreneurship, and establishing supportive governance for the Internet ecosystem. This paper advances the policy debate with particular reference to education in Africa. It discussed areas that need to be addressed to improve Internet use for education.

⁵⁷ Internet Society, A Policy Framework for Enabling Internet Access, <http://www.internetsociety.org/doc/policy-framework-enabling-internet-access>

Internet for Education: A Score Card for Policy Makers

| Theme | Issue | Mark X if achieved or ---, if not |
|--|--|-----------------------------------|
| Holistic Vision | The Government has committed to Internet Society Enabling Environment Framework | |
| | The government has a policy on ICT for education | |
| | The government embraces one-to-one computing like OLTP and tablet use in schools | |
| | The government policy pays attention to schools in remote and underserved areas. | |
| | Policy vision focuses on content and learning outcomes | |
| Infrastructure | The government is committed to providing access to broadband at an affordable rate (e-rate) | |
| | The Ministry of Education and the Ministry of Communication have agreed to work together towards bringing affordable broadband access to all educational institutions | |
| | The Ministry of Education and the Ministry of Energy/electricity board and the private sector have agreed to work towards ensuring access to grid electricity or alternative sources of energy | |
| | The government has committed to provide resources for rolling out one-to-one computing, Internet access, software and applications to all schools | |
| | The government has introduced guidelines to ensure that new school buildings are ready for a blended form of education and/or virtual education | |
| Teacher Professional Development | The government is aware of and/or adopted a holistic ICT competency framework for teachers (the UNESCO Competency Framework) | |
| | ICT competency is integrated in teacher training institutions' curriculum | |
| | Teacher training institutes have ongoing and sustained ICT in education training for in-service teachers | |
| | The government has established incentives for teachers that achieve competency and are able to integrate ICTs in teaching, learning and assessment | |
| Capacity building for decision makers, college and school leaders | The government has a framework for raising the awareness of ICT applications in education of college leaders and school principals | |
| | Adequate resources are allocated for building the capacities of college leaders and school principals in ICT application in education | |
| | The government has initiated programs for exchange of experience with other countries in the areas of ICT in education | |
| Learning Resources, Content and Applications | National textbooks are available for download over the Internet | |
| | Institutions and the government have repositories that allow for exchange, adaptation and creation of Open Educational Resources | |
| | The government has established an incentive framework for those creating, adapting and sharing educational resources, especially in local languages | |
| | The Ministry of Education is involved in regional and global discourse and initiatives on Open Educational Resources | |
| | Government's efforts are compliant with the principles contained in the Paris Declaration on OER. | |

| | | |
|--|---|--|
| Technical Vocational Education, Skills and Youth Employment | TVET and higher education institutions have developed an ICT skills framework that supports youth employability and IT-enabled services jobs | |
| | TVET institutions have integrated MOOCs and OERs into the teaching and learning process | |
| Stimulation of National Research and Education Networks | The government has programmes to support National Research and Education Networks | |
| | The government has allocated resources for National Research and Education Networks | |
| | The government has a strategy and regulatory provisions to provide affordable bandwidth to research and education institutions | |
| Equity and Inclusion | The ICT in education policy of the government addresses equity and inclusion issues, especially those related to gender and disabled people | |
| | The government supports programmes that encourage girls' and women's use of technology for education | |
| | The ICT in education policy, strategies and programmes promote inclusion of disabled people | |
| Safety, Privacy and Child Protection | The government has created an institutional framework and strategies to address child protection and digital safety | |
| | The government has adopted the Internet Society Trust Framework | |
| | The government has created a legal framework to address digital safety, privacy and child protection | |
| | Educational institutions and the government have established technical approaches to address digital safety, privacy and child protection | |
| | Schools, colleges and universities have a framework for raising the awareness of students and teachers on digital safety, privacy and child protection issues | |
| Data Collection (EMIS) | The Government has established a framework for systematic collection of data on ICT investment in education at all levels | |
| | ICT data is fully integrated in Educational Management Information Systems | |
| | Institutions and the government have leveraged social media and other advances in open data to collect and exchange ICT and Internet data in education | |
| Monitoring, Evaluation, Research and Learning | The Government has supported centers of excellences that carry out research on technology use in education | |

Internet for Learning: Resources for Policy Makers

| Theme | Issue |
|--|---|
| Holistic Vision | <p>Michael Trurano, Key themes of National ICT Policies, http://blogs.worldbank.org/edutech/key-themes-national-educational-technology-policies</p> <p>ICT for education policy web site https://www.ictedupolicy.org/resource-search-results?keyword=Policies%20&%20Plans</p> <p>United States, Transforming American Education: Learning Powered by Technology, https://www.ed.gov/sites/default/files/netp2010.pdf</p> <p>ICT in Schools, Inspectorate Evaluation Report, https://www.education.ie/en/Publications/Inspection-Reports-Publications/Evaluation-Reports-Guidelines/ICT-in-Schools-Inspectorate-Evaluation-Studies.pdf</p> <p>Internet Society, A policy Framework for Enabling Internet Access, http://www.internetsociety.org/doc/policy-framework-enabling-internet-access</p> |
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Abbreviations

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| AAU | Association of African Universities |
| APAN | Asia Pacific Advanced Network |
| ASREN | Arab States Research and Education Network |
| CoL | Commonwealth of Learning |
| EFA | Education for All |
| EMIS | Education Management Information System |
| EC | European Commission |
| ICT | Information and Communication Technologies |
| IP | Internet Protocol |
| IRU | Indefeasible Right of Use |
| ITU | International Telecommunications Union |
| MIT | Massachusetts Institute of Technology |
| MOOC | Massive Open Online Classes |
| NEPAD | New Partnership for African Development |
| NREN | National Research and Education Networks |
| OCW | Open Courseware |
| OECD | Organization for Economic Development and Cooperation |
| OER | Open Educational Resources |
| REN | Research and Education Networks |
| RREN | Regional Research and Education Networks |
| SDG | Sustainable Development Goals |
| TVET | Technical and Vocational Education and Training |
| UA | UbuntuNet Alliance |
| UIS | UNESCO Institute of Statistics |
| UN | United Nations |
| UNESCO | United Nations Educational Scientific and Cultural Organization |
| WACREN | West and Central African Research and Education Network |

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