

Report Part Title: ICT and Education

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6 ICT and Education

Embracing the Goals

SDG 4 sets out a bold education agenda with the aim of ensuring “that all girls and boys complete free, equitable, and quality primary and secondary education.” It is supported by targets calling for:

- Target 4.1: All girls and boys to have access to quality early childhood development
- Target 4.2: Equal access for all women and men to affordable and quality technical, vocational, and tertiary education
- Target 4.3: That all youth and a substantial proportion of adults achieve literacy and numeracy
- Target 4.6: A substantial increase in the supply of qualified teachers

SDG 4 extends beyond the Millennium Development Goals’ central focus on primary education enrollment. It emphasizes the importance of early childhood development through to secondary education and advanced training in skills or tertiary learning, and calls for universal secondary completion rates.

Five core values underpin the education-related SDGs: a) the right to education, b) equity in education, c) inclusive education, d) quality education and e) lifelong learning opportunities.¹⁰⁵ SDG 4 does not set out how its ambitious objectives can be accomplished but the creative integration of ICT into teaching, learning and education systems management will be essential.

Facing the Challenge

Education for all remains an elusive goal. Some 57 million children¹⁰⁶ of primary school age are out of school and universal secondary education remains a huge challenge for many low-income countries, notably in sub-Saharan Africa. Gross enrollment rates in secondary school remain below 50 percent in much of the region, with gross enrollment rates for higher-secondary education lower still—often under 30 percent¹⁰⁷ particularly in the Least Developed Countries. Lack of basic infrastructure and conflict-prone areas are key issues preventing 100 percent enrollment and school survival in sub-Saharan Africa. Adolescent pregnancy continues to be a key driver of dropouts in the region, resulting in the exclusion of girls from secondary schools. Even when good enrollment and completion rates have

been achieved, this can be offset by natural disasters or political uprising: in Syria, just two years of conflict after 2011 effectively erased 15 years of progress.¹⁰⁸

The acceleration made possible by ICT has a key role to play in overcoming these challenges by driving advances in all aspects of education and helping to prepare students to contribute meaningfully to the Networked Society.

6.1 Introduction

Education is the single most important investment in long-term economic development once basic issues of survival and essential nutrition are addressed. Investing in education and skills—often termed human capital—accounts for a significant share of long-term economic growth¹⁰⁹ and is now recognized to be even more important than previously understood: quality education throughout the lifecycle, from early childhood through adulthood, is essential for achieving prosperous and inclusive societies.

The MDGs recognized this, and the SDGs are carrying this agenda further still. The MDGs made significant progress¹¹⁰ in paving the way for universal primary education with a 42 percent drop in out-of-school children of primary-school age and an increase in the youth literacy rate from 89 to 91 percent.¹¹¹ Although the MDGs did not meet all their education targets—and outcomes varied across regions—progress since 1999 in the net primary enrollment rate has been striking. Between 1990 and 2012, the net enrollment ratio in primary schools in sub-Saharan Africa more than doubled from 62 to 149 million children.¹¹² Efforts to achieve MDG 2 have also given the global community invaluable experience and insight to draw on in achieving SDG 4.

UNESCO has underlined the importance of the education sector for achieving sustainable development outcomes in all other areas.¹¹³ To harness the potential of education, five key areas for action were identified by global leaders at the World Conference on Education for Sustainable Development in Japan¹¹⁴ in 2014: 1) advancing policy, 2) whole-institution approaches to learning and training environments, 3) increasing capacities of educators and trainers, 4) empowering and mobilizing youth, and 5) encouraging local communities and municipal authorities to lead education for sustainable development programs.

BAU won't deliver the results

Conventional education programming—in which the number of classrooms, teachers and supplies grow at the business-as-usual (BAU) rate—will not come close to achieving SDG 4. In Africa, for example, the enrollment rate in upper secondary education went from around 20 percent in 1999 to

Education programs based on children's home languages have higher levels of participation, success and enjoyment [As well as parental involvement] and lower levels of repetition and drop-out, especially among girls.”

(UIS and UNICEF, 2015)

35 percent in 2012.¹¹⁵ Continuing at that rate of improvement might deliver a rise of 40-50 percent by 2030—far short of the 100 percent rate envisioned in Target 4.1.

ICT's accelerator role is a powerful mechanism in every aspect of education: teacher training, local curricula, local-language instruction, monitoring and assessment of student performance, education-systems management, coaching and mentoring, and preparing students for a world in which ICT is a necessity for successfully navigating their future careers and lives and contributing to their national economies.

With 3.1 billion people in the age group of 0-24, the education sector will immediately impact the lives of over 40 percent of the world's population, and will greatly affect the prospects for overall economic development.

SOURCE: Data from the UNESCO Institute of Statistics website

“Education is the fundamental method of social progress and reform.”

(John Dewey, 1897)

6.2 Education is central to achieving the SDGs

According to the World Bank Global Monitoring Report¹¹⁶, which tracks progress towards global development goals, “Education’s unique power to act as a catalyst for wider development goals can only be fully realized, however, if it is equitable.” Beyond mere enrollment or completion rates, to meet the SDGs it is therefore vital that countries focus on the quality of teaching and learning in the classroom throughout the education lifecycle. That is a serious financial investment which is currently beyond the reach of most developing countries; innovative solutions such as those offered by ICT can go a long way in bridging the gap.

The total expenditure necessary to achieve the SDG education targets by 2030 is USD340 billion in developing countries with additional annual funding of USD39 billion to provide 12 years of free education.¹¹⁷

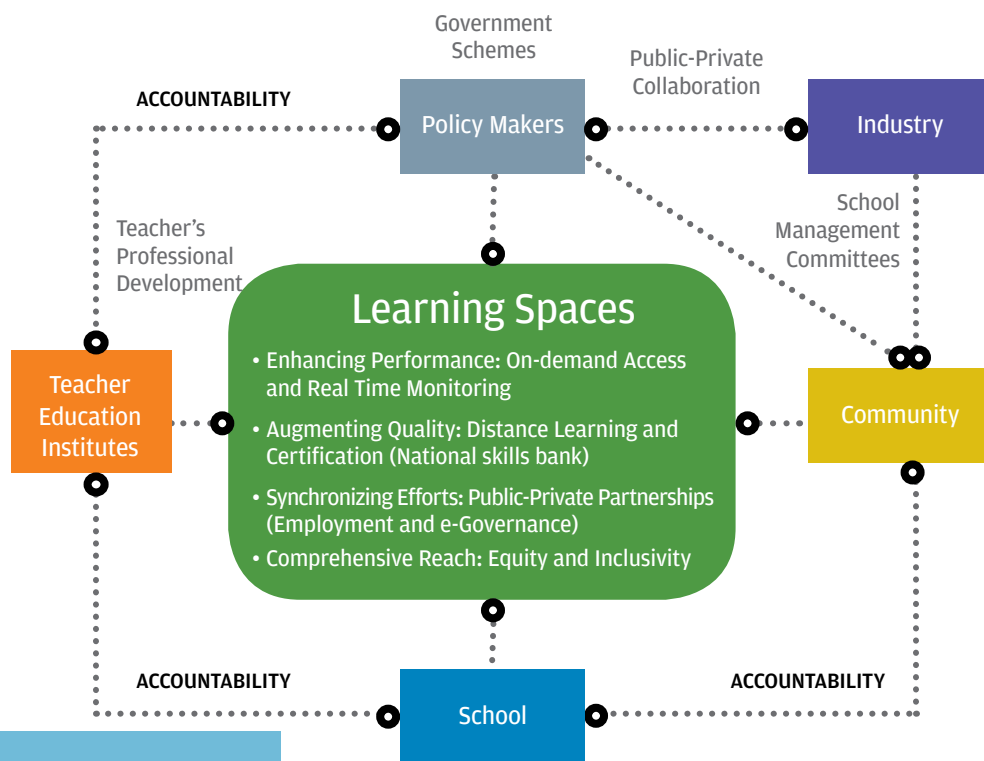
Source: Education for All Global Monitoring Report 2014, UNESCO

Quality of education is critical for long-term economic growth. Cross-country and cross-regional patterns of economic growth are strongly influenced not only by the number of years of schooling but also by the quality of schooling as measured in international comparative testing.¹¹⁸ Studies have shown that the stronger a country’s average test scores, the faster its economic growth.¹¹⁹

Early childhood development (ECD) has the highest return of all educational investment, providing an invaluable base for subsequent learning.¹²⁰ Experts have shown that deficits in early childhood development are difficult—if not impossible—to surmount in later years:¹²¹ early childhood stress can lead to lifelong debilities, while early structured play with adults and other support in early childhood can improve executive function skills needed for lifelong learning, coping and problem solving.¹²²

To harness the potential of education as a driver of human wellbeing and deliver the kind of progress envisioned by SDG 4 requires an enabling environment where adequate financial resources—including through private investment—

Figure 6.1: Conceptual Framework for Learning Spaces (Source: Earth Institute)



align with progressive policy, human capital and innovative technology to allow rapid scaling of development goals. Recent advances in ICT offer an attractive, innovative platform for curriculum development, training of teachers and other education workers, classroom instruction, mentoring, tutoring and coaching, as well as real-time collaboration and knowledge-sharing.

The framework shown in Figure 6.1 advocates a re-imagining of educational intervention and delivery, leveraging ICT, social capital, public-private collaboration and active participation of the community in decision-making to provide the necessary boost to achieve the SDGs by 2030. 'Learning Spaces' are educational environments that use ICT while preserving the core themes of equitable, inclusive and quality life-long learning opportunity.¹²³ Key elements of the 'Learning Space' include:

- 1) Enhancing performance: on-demand access and real-time monitoring.
- 2) Augmenting quality: distance learning and certification (national skills bank).
- 3) Synchronizing efforts: public-private partnerships (employment and e-governance).
- 4) Comprehensive reach: equity and inclusivity, including of ICT-based educational services.

6.3. ICT in action: Transforming education

ICT-based innovation is occurring throughout the education value chain. Recent ICT-based advances for educational systems include ICT for spatial planning, Massive Open Online Courses (MOOCs), and distance training, tutoring, and mentoring. Through ICT, the learning space is no longer limited to a traditional classroom, shifting educational delivery to the palms of every individual. ICT provides an unprecedented, cost-effective platform for governments, schools, teachers, communities and businesses to collaborate effectively and accountably in pursuit of SDG 4.

ICT can enhance education performance in a multitude of ways. It enables delivery of high quality content regardless of location. It provides a mechanism for ongoing teacher pedagogy, professional development and communities of practice. It can generate valuable data to assist with planning. Significantly, it also enables substantial reduction of delivery costs.

Through ICT, the learning space is no longer limited to a traditional classroom, shifting educational delivery to the palms of every individual.

6.4. A world-class education, anywhere in the world

ICT enables a unique opportunity for a world-class education, anywhere in the world, by rapidly disseminating quality content to end-users at reduced cost. Gone are the days when current curricula depended on printing and transporting often-outdated books to schools. Cloud-based systems with business models that require no or low upfront investments such as Connect To Learn lower barriers for schools to introduce a quality education (see Case 6.1) especially in more remote, rural, low-resource areas. The benefits accrue not only in educational content but also in student learning and teaching pedagogy and professional development.

Cloud-based platforms can also greatly reduce the operational costs of maintenance and connectivity. Broadband connectivity stands to enhance significantly the scale of digital education. High-speed streaming and maintenance at little cost can be a huge boon to service providers, creating multiple channels for content dissemination and ensuring a quick return on the fixed costs associated with content design and development and technology deployment. Pratham Virtual Open Schools (Case 6.2) showcases some of the salient issues in the use of ICT for content provision.

Support for teachers

Bringing education to students everywhere, with the help of ICT, is only part of the challenge. There must be sufficient teaching resources as well, and in many countries this is severely lacking. Sub-Saharan Africa faces the greatest challenges, with a total of 2.7 million teachers needed in schools today – and the situation will likely get worse as the region struggles to accommodate a growing school-age population.¹²⁴

Teachers have an important role in guiding students to use ICT effectively. Increased access to professional development support and improved classroom management techniques help enhance teaching practice. In designing and implementing ICT teachers' training programs, the most successful outcome is when teachers learn how to integrate tools into teaching practice.

Teachers skilled in pedagogical uses of ICT can support quality, individualized learning opportunities for students. ICT can also contribute toward teachers' improved pedagogical skill, including but not limited to ICT-integrated pedagogies. While in-person support is always necessary for training teachers, especially those new to technology, ICT can offer a

Case 6.1: Expanding access to quality education with Connect to Learn

Connect To Learn (CTL) is a partnership of the Earth Institute at Columbia University, Ericsson and Millennium Promise, whose mission is to address the lack of universal access to quality education, with particular emphasis on the marginalized (especially girls) in resource-poor settings globally. CTL aims to achieve this mission by enabling access to quality instructional and learning resources through innovative teaching practices and technology tools in schools. It aims to ensure that each child is schooled at least to secondary level and equipped with 21st century skills to help increase their professional opportunities and improve their quality of life.

Founded in 2010, CTL initially deployed technology solutions in remote schools with few existing educational resources. The technology solution was designed to use mobile communications networks to enable access to quality education resources available via the Internet and to scale. The solution was optimized to run on low bandwidth and to serve teachers and students with little or no technical competence. The cloud-based solution aims to remove the complexities of virus protection, software updates, application installation and maintenance. This is especially important in areas with intermittent connectivity. A lack of ICT and pedagogical skills among teachers proved significant barriers in uptake of ICT integration in classrooms.

Lessons learned

A one-year Collaborative Action Research (CAR) study of secondary schools in Uganda and Kenya carried out by senior education researchers from the University of Nairobi in Kenya, Kampala University in Uganda, and Teachers College of Columbia University in New York¹²⁵, set out to deepen understanding of how to best implement ICT tools in secondary schools in resource-poor settings. By systematic implementation of ongoing teacher professional development to integrate basic ICT skills into teaching preparation and classroom practice, the study found significant increases in teachers' reported skill and comfort with using ICT for educational purposes, including in their observed use of ICT in the classroom. At the beginning of the project only 21 percent of teachers considered themselves to be 'advanced' users of ICT; by the end, 45 percent reported themselves to be advanced users. There was also an 18 percent increase in reported use of ICT in the classroom.

Other key insights:

- 1) School leadership is vital to drive integration of ICT tools and enabling environment for ICT in classrooms.
- 2) As teachers became more skilled, their perceived barriers to using ICT in teaching shifted.
- 3) Weak connectivity severely hindered teachers' efforts to find online resources; school servers populated with resources can supplement wi-fi routers.
- 4) Building confidence and skill of teaching staff and encouraging innovation in teaching styles through integration of ICT takes time and persistent effort. Sustaining progress requires continued and consistent support for teachers.

Applying lessons learned in Myanmar

The largest Connect To Learn project to date, funded by Ericsson and the UK's Department for International Development, is a partnership in Myanmar that includes Ericsson, UNESCO, the Earth Institute, the Myanmar Ministry of Education, Qualcomm, FinjaFive and EduEval. The program is being implemented in 31 schools. New locally relevant digital content is being created and delivered on a child-friendly interface and Ministry of Education officials are being supported to provide teacher professional development in ICT integration. The monitoring and evaluation framework first developed during the CAR study is now being extended and implemented in Myanmar to monitor the program's impact on student learning outcomes and girls' empowerment, and the framework will continue to guide all Connect To Learn projects going forward.

Source: Earth Institute and Ericsson

Case 6.2: Pratham Virtual Open School

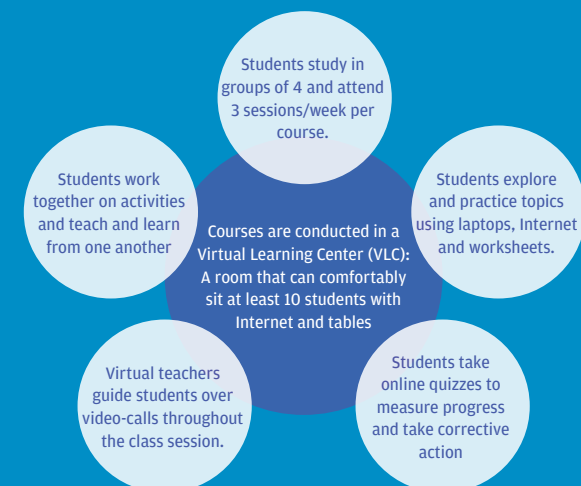
Pratham, India's largest education NGO, in partnership with the UN Sustainable Development Solutions Initiative (SDSN), launched its Virtual Open School program "Open Schools Online" in 2014, with the aim of leveraging technology to improve quality of education at scale in low-resource settings. Pratham's Virtual Open Schools (PVOS) project develops and demonstrates low-cost technology and pedagogy interventions that can be scaled to impact children's ability to learn, and thus their academic outcomes.

PVOS is an 'out-of-the-box' program to roll out Virtual Learning Centers (VLCs) within schools and communities. Designed as a two-year pilot aimed at 10-18 year olds, the program provides 'courses' that schools, NGOs and local educational entrepreneurs can offer to in-school and out-of-school children. In 2015-16, foundation courses in Math, English and computer usage were offered across two states in India (Rajasthan and Telengana) both in and outside schools, reaching approximately 2,500 students. Each course requires students to attend approximately thirty sessions of ninety minutes each.

For students, the course includes interactive course content to be accessed through a laptop or tablet and access to virtual teachers over Skype during every class period.

For schools, NGOs and education entrepreneurs, benefits include a web portal to register students and track their learning progress and learning outcomes, training for VLC facilitators and hardware set-up guidelines and support.

Figure 6.2. Pratham Workflow Diagram



In order to be able undertake program such as the PVOS, students must first have proficiency in basic Hindi, Mathe-

matics and English. To date Ericsson has partnered with the Pratham Education Foundation to support its Learning Excellence Program (LEP) in 28 schools in Gurgaon. The LEP offers teacher training that assists 2,188 students in English, Hindi and Math classes by training 55 teachers in these schools. All teachers are given training throughout the year with the intention of equipping them with the required skills to take students from one learning goal to another. The project also includes a library Program which provides assisted reading to all pupils in the school. The basic skills provided by this program are critical to ensuring their ability to effectively communicate and partake in digital literacy training and engaging with the digital economy.

Lessons learned

Initial results show powerful takeaways for educators and policymakers. Among them:

- Providing enough immersion time for students is essential to reap the benefits of the technology deployed.
- Incorporating technology into self- and group-learning instruction boosts self confidence of children , especially those who otherwise perceive themselves to be poor learners.
- Customized content tailored to learning in local languages and grade-appropriate levels is essential.
- Some students benefit most from smaller groups in which teacher interaction allows for individual tutoring and support.
- Interaction with the virtual teacher has removed traditional barriers to engagement in the classroom (such as viewing teachers as figures of authority) This encourages children to be more willing to ask questions.
- Technology enables immediate and actionable feedback for teachers, with every child's progress mapped in real time. This allows for faster response times from teachers and schools.

The PVOS model shows that technology can help overcome the initial barrier of learning, however this must be supported by careful design integration to ensure that children continue to learn and sustain their engagement and performance. The greatest potential of technology in education is its power to deliver large-scale improvements in student learning through a combination of self and group-learning content, structured sessions and accessible teachers. Without carefully integrating technology in the design of education delivery, its impact is likely to be limited. When introduced thoughtfully, it can transform the entire structure of the school system.

Geography counts when it comes to teacher presence, student school attendance and educational performance. When children in rural areas are far from schools, they are much less likely to attend and teachers are also far less likely to show up for work. ICT can pinpoint the geographical hotspots.

great opportunity for teachers to participate in blended models of teacher professional development.

Programs like Connect to Learn (Case 6.1.) are designed to address barriers to teaching by removing technical hurdles such as application updates, virus software etc. By managing everything in the cloud, CTL ensures teachers don't need to be IT experts, and can focus on teaching.

Programs like Intel Teach offer teachers interactive professional development modules on teaching methods that integrate ICT, as well as access to content and opportunities to interact and share ideas with other teachers around the world. The Teacher Education for sub-Saharan Africa (TES-SA) initiative offers curriculum-aligned lesson plans, resources and opportunities for teacher interaction online, all designed by faculty from African colleges of education.

6.5. Gathering the data insight

Insight into the outcome of different educational approaches and investments will be instrumental in understanding progress towards the SDGs, and ICT can greatly enhance data generation and processing. In the last five years there has been a surge in research on data for education, and availability of timely and rich sustainability data is seen as a key tool for mitigating challenges and achieving the SDGs by 2030.¹²⁶

To reap the benefits of ICT's data generation, teachers and school leaders need to be able to access and analyze information¹²⁷ through continuous professional development training as well as data collection of relevant indicators. Armed with that competence and insight, there is potential to greatly enhance educational capabilities in a region.

Access to quality assessment data in education is in its infancy compared with other high-performing industries.¹²⁸ Although standardized tests such as PISA provide a comparison for student performance, this information is of limited use in classrooms as it is not timely enough to guide teachers' instructional practice.

Continuous student monitoring, such as formative assessments, immediately highlights gaps in student understanding and supports instructional design. Access to real-time

data helps identify gaps, successes and resources required to enhance strategic planning. Teachers using the Tanzania curriculum-aligned eLearning platform Studi have noted that the program helps them better understand where individual students are struggling via gameified assessment exercises.

Online questionnaires and data mining algorithms will permit much more accurate predictions of student performance and dropout risks, paving the way for preventative or corrective actions to keep girls and boys in school through secondary completion.¹²⁹

6.6. Putting a better educational plan in place

Educational planning is integral to effective policymaking. ICT-enabled data gathering and geospatial analysis greatly increases the efficiency of the national planning process. One critical aspect of this is to create a geographical distribution of educational facilities that ensures equity in access and opportunity. Spatial data on education facilities can provide invaluable support for such educational planning. The Earth Institute worked with the Government of Nigeria to provide spatially based systems information at the national scale, using ICT, as discussed in Case Study 6.3.

The importance of proximity to schools as regards teacher presence, student school attendance and educational performance has also been confirmed by an Earth Institute analysis of a Millennium Development Village in Mali, where student attendance is high in the area proximate to the schools, beyond which it drops markedly. Similar observations have been made in Chile.¹³⁰

6.7. Distancing learning and certification

Serving teachers and students in low-income rural areas is a significant challenge. Teachers are at the core of delivering and supporting education, especially with the ever-increasing demand to reduce the global student-to-teacher ratio. Yet the world faces a shortfall of teachers.

To meet SDG 4, strong emphasis needs to be placed on supporting professional development of teachers through teacher education and providing lifelong learning opportunities to create

Case 6.3: Nigeria MDG Information System¹³¹

The Earth Institute in collaboration with the Nigerian Government launched the Nigerian MDG Information System (NMIS), a web-based platform to equip the authorities with data-driven decision-making as a first step towards ensuring equitable and quality educational opportunity promised by SDG 4.¹³²

The NMIS provides useful data that can facilitate real-time decision-making. Indicators such as spatial location of schools, enrollment, infrastructure, school resources, student and teacher attendance, school fees and school budgets provided information on the health of the education system with respect to the Millennium Development Goals.

Lessons learned

Integration of the NMIS increased the transparency of data and processes, and ensured that grant and aid reached the places

that needed it most. The collection of data through ICT devices such as mobile phones ensured quick turnaround in the availability of the latest information relevant to stakeholders.

The NMIS indicators were developed collaboratively with the Nigerian government and sector specialists to ensure that the system is grounded in the Nigerian context. The involvement of local stakeholders was paramount as it ensured relevance of the system in the context and increased participation in the program.

The key lesson learned is that a national-scale, high-quality spatial inventory of facilities for a large country such as Nigeria can now be undertaken at low cost in a matter of months, not years.

a nurturing environment for high-risk students—no matter where they live. ICT can be mobilized for large-scale, distance student learning, teacher training and skill development.

The Indira Gandhi National Open University (IGNOU) in India is a prominent example of large-scale distance education.¹³³ The coursework is designed by professors from leading national colleges, with IGNOU responsible for the dissemination and testing of student work. MOOC-based instructional delivery promises to add immense value to the pedagogy of IGNOU and programs like it, as the MOOCs can provide a structured learning path for students while fostering communities of learners through the platform.

With the recent advent of Massive Open Online Courses (MOOCs) education is now available at zero marginal cost for anyone with an Internet connection. The total number of students who signed up for at least one MOOC course crossed 35 million in 2015, more than doubling from the previous year.¹³⁴

Online education expands the ability to offer low-cost training to a much larger cohort of trainees, and may deliver educational benefits compared with traditional face-to-face instruction. There is evidence to suggest that blended learning—combining the two forms—is most effective.¹³⁵ The MOOC approach, whether as stand-alone online courses or blended courses, may provide the much-needed solution to “affordable quality technical, vocational and tertiary education, including universities” of SDG Target 4.3.

To meet SDG 4, various forms of blended teacher training will be vital for upgrading both the number and quality of teaching staff, given that current rates of teacher education are inadequate to achieve the goal.

Importantly, ICT helps foster strong, online communities of practice that enhance learners’ interaction.¹³⁶ Such communities help individuals understand the importance of collaboration to support and transform their own learning, reducing isolation and reinforcing sharing, communication and exchange of best practice with supervisors and peers.¹³⁷

Online platforms such as Coursera, EdX, EdCast, and Udemy host students from over 190 countries, including India, China, Brazil and Mexico, and provide technical and vocational training through curated and structured content and enhanced online social interaction. Coursera, the largest online course provider in the world, had 17 million students in 2015.¹³⁸

Online learning platforms show great promise for accelerating literacy and numeracy efforts as large numbers of students can engage with the content simultaneously.

The traditional model of brick-and-mortar universities is running into supply constraints with steeply rising tuition and operating costs. Online courses or blended courses may provide the much-needed solution

The Jokko program, for example, was launched in Senegal by UNICEF in 2007 and aims to develop community literacy by “increas[ing] communication and collaboration within communities, with special emphasis on empowering women, through a mobile phone-based group message system.”¹³⁹ Blended or hybrid course design also affords students engagement opportunities with a diverse student cohort.

For university-level online courses, the aim ultimately is to ensure that the online programs offer at least the same quality and rigor of instruction as those in leading universities. The UN Sustainable Development Solutions Network (UN SDSN), for example, is developing an online curriculum in

sustainable development offered by world-leading academics, as discussed in Case 6.4.¹⁴¹

6.8. Leveraging public-private partnerships

ICT equips students, educators and administrators to perform tasks more efficiently and at lower cost. Public-private partnerships and impact investing can provide a key source of funding for global education, with private-sector educational content providers and trainers teaming up with governments to devise novel, cost-effective delivery models. A prominent example of how this works in action is the Connect to Learn program on Myanmar (Case 6.1).

With the financing gap for basic education growing, and education investments inefficiently allocated within countries, urgent action is required to close the gaps and achieve the SDG education targets by 2030. The International Commission on Financing Global Education Opportunity, led by former UK Prime Minister Gordon Brown, is tackling this by

Case 6.4: Training sustainable development practitioners¹⁴⁰

Over a hundred thousand people from around the world have taken advantage of an online training platform on sustainable development called SDSNedu (www.sdsnedu.org). Launched by the Sustainable Development Solutions Network (SDSN), a global network of over 300 universities, to support the UN in promoting sustainable development, SDSNedu offers a set of high-quality, online courses offered by renowned global experts. The courses bring together the best available evidence and educational content on issues related to sustainable development, hosted on an interactive platform integrating videos, audio-visual and graphic elements to raise accessibility and engagement. The platform allows for student discussions and faculty engagement at a much more granular level than otherwise possible. In addition, the courses are made available for SDSN member institutions and other partners to use within their academic and training programs as core content.

Lessons learned

Experience with the first few courses has demonstrated that despite the rapid growth of online courses available through multiple platforms, there is an enormous demand for focused, high-quality courses that allow students to gain expertise and awareness about a key field (in this case, sustainable development) in a targeted, focused and interconnected manner. SDSN

edu has also identified an enormous unmet demand from educational institutions, particularly in emerging markets, for locally tailored programs on sustainable development. The need for both global and locally specific content suggests the case for blended learning where students are simultaneously part of a global community while also being rooted in their local academic experience.

Transforming higher education

SDSNedu shows that higher education is poised for transformation—where global experts can reach several hundred thousand students, where the per-student cost of creating and running academic programs drops dramatically, and where connectivity ensures that students, irrespective of location, have access to high-quality learning materials. The success of technology in higher education will depend on 1) how it is used to create blended programs that are tailored to the specific needs of students; 2) how accreditation can evolve to benchmark global and locally relevant competencies; and 3) how well it can mimic the interactivity of a small classroom setting. Technology has the power to propel convergence in quality across institutions in developing and developed countries by referencing common learning standards—the SDSNedu experience is testimony to this power of large-scale educational change.

Gender-based disparities will be a pressing challenge for the SDGs. Over 400 million women in the world are unable to read full sentences. Of out-of-school children, 48 percent of the girls have never been enrolled in a school.

seeking out path-breaking research and policy analysis that create best practices to increase investments in education, and then motivating world leaders and private actors to commit to bridging the gaps.¹⁴²

6.9. Achieving gender parity

Women and girls are disproportionately affected by the global education gap.

Gender disparity is even more prevalent in secondary education. In Angola, gender inequity has worsened from 76 girls per 100 boys in 1999 to 65 in 2012, while in conflict areas such as Chad there were roughly half as many girls as boys in secondary school in 2012.¹⁴³

Child marriage and pregnancy of adolescent girls also contribute to increased female dropout rates. Initiatives that permit mothers to continue learning decrease dropout rates. As shown in Figure 6.3, on current trends, girls are far behind boys in finishing critical education milestones, and a BAU path will be incompatible with achieving SDG 4.

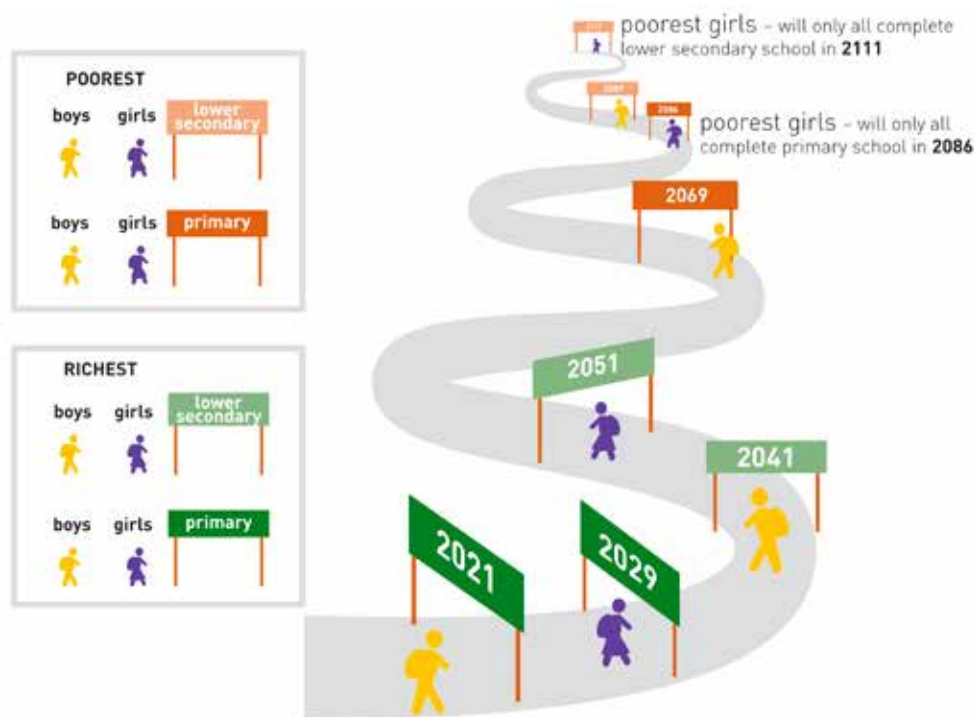
ICT-based remote learning opportunities are one way for girls to continue their education. The importance of ICT for gender parity is acknowledged in SDG target 5.b, which calls on development partners to “Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women.”

Sexual education, provision of youth-friendly health services, counseling, gender awareness training and condom distribution in Kenya have also helped reduce pregnancies in targeted schools from 1 in 29 girls in 2006 to 1 in 97 girls in 2009.¹⁴⁵ Community-wide campaigns helped facilitate the reduction of child marriage in the Amhara region from 74 to 56 percent between 2005 and 2011.

ICT can also offer an e-counseling component. The Girls Excelling at Math and Science (GEMS) initiative, for instance, links secondary school girls to female professionals over Skype in order to engage in mentorship.

Various schemes and services aimed at educating girls and women is more easily disseminated, thanks to ICT, through web-based media, Internet radio and e-training initiatives led

Figure 6.3. The journey to complete education in sub-Saharan Africa¹⁴⁴



by trained local community facilitators at early childhood centers, primary and secondary schools. ICT can also enable continuing education of adolescent mothers through distance learning platforms and ICT-based educational interventions.

Infrastructure also plays an important role in providing the enabling environment identified in SDG Target 4.a. Enrollment of girls in school is adversely impacted by an individual's distance from school: in Chad a study conducted in 179 villages showed that enrollment dropped dramatically when

schools were in other villages, with the drop in enrollment significantly greater for girls than boys.¹⁴⁶ Growth in enrollment owing to the presence of a school in a child's immediate locality was also observed in Afghanistan, where villages with primary schools saw a 42 percent increase in enrollment with a greater proportionate increase among girls, thereby reducing the gender gap. The Earth Institute in collaboration with the Sustainable Engineering Lab at Columbia University have used GIS mapping of schools and children by age category to analyze the best locations for new schools.

Figure 6.4a. Gender Disparities in Primary School map from the UNESCO eAtlas

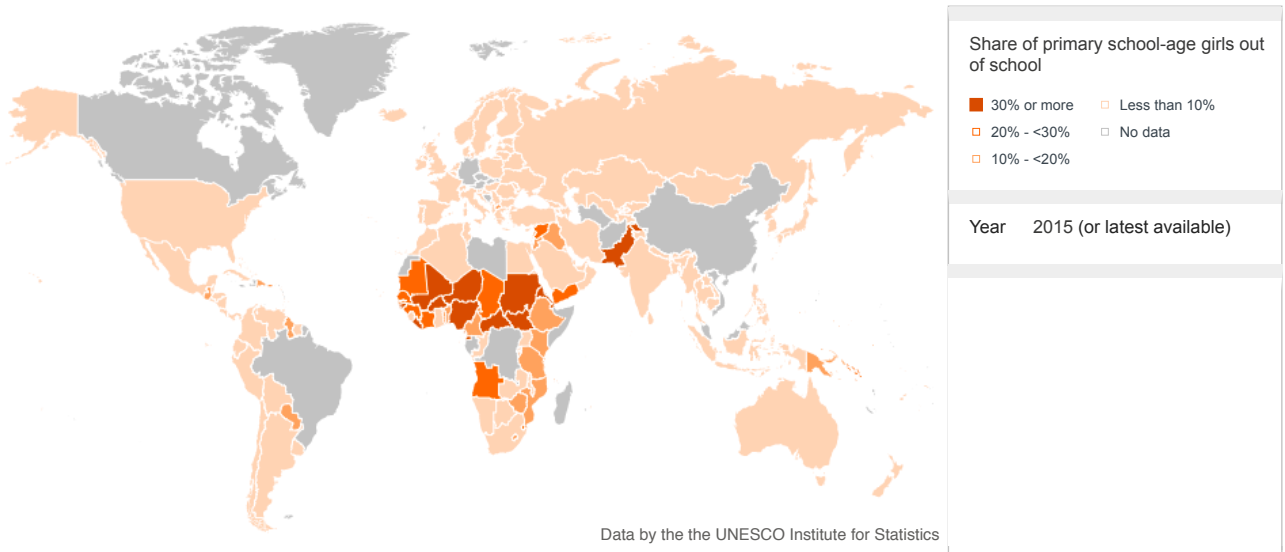
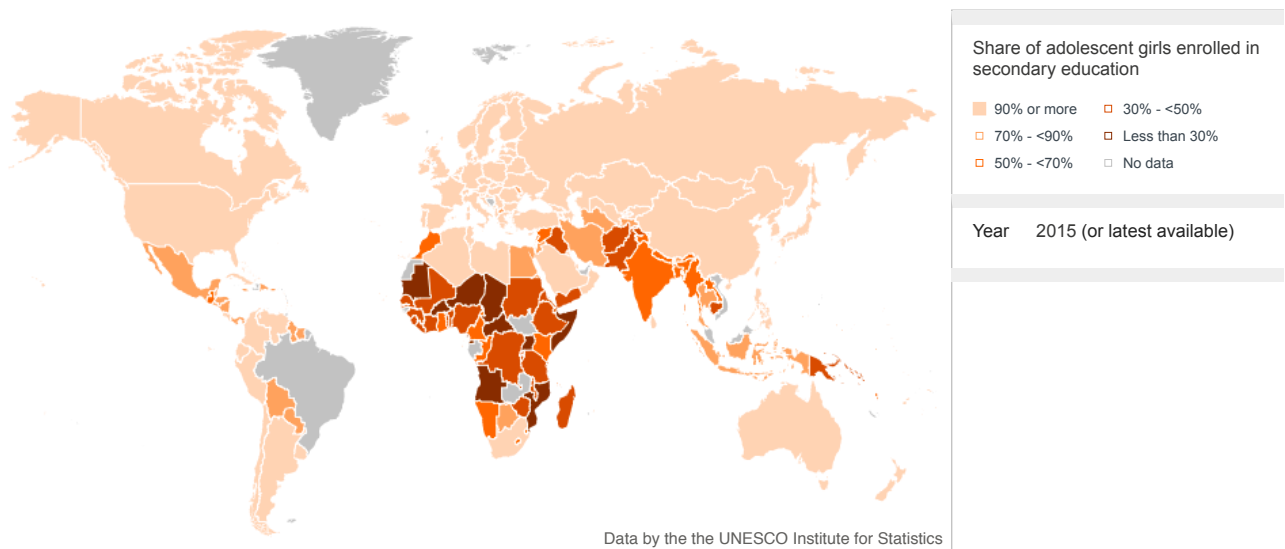


Figure 6.4b. Gender Disparities in Secondary School map from the UNESCO eAtlas¹⁴⁷



6.10. Students with learning disabilities and special needs

Promoting inclusive societies and institutions, as called for under the SDGs, includes amplifying accessibility to persons with disabilities (PwDs). This entails removing barriers—so that persons with disabilities can use ICTs—and establishing enabling environments for ICT accessibility, including web accessibility. By offering alternative communications links, broadband technologies and services can help promote equal opportunities for PwDs.¹⁴⁸

ICT and computers in general have been shown to help children with learning disabilities to make significant improvement in phonological awareness, word recognition and letter-naming skills.¹⁴⁹ Adaptive technologies such as language recognition (e.g. Dragon Naturally Speaking 8.0) and Braille 2D screens for the poor can be deployed where needed through the cloud.

In Denmark, IT accessibility for people with impaired functionality is an important focus area in the achievement of joint public goals regarding full digital communication between citizens and the public sector. However, a 2010 Danish IT and Telecom Agency's 'Webtjek' survey of accessibility of public websites showed that there was room for improvement: only a little under half (48 percent) had few or no serious accessibility problems, while a little over half of websites surveyed (52 percent) had several functionalities or content that were not accessible. Following the survey, information and consultancy provision has been tightened up, and new e-learning modules on IT accessibility have been developed for a wide range of public employees.

Key success factors have included establishing a comprehensive monitoring framework based on industry-wide metrics and indicators. This is an important aspect of broadband and ICT deployment to ensure equal access for all. Government web accessibility includes surveying existing government websites to measure their accessibility levels in compliance with international standards, and setting targets for implementation of web accessibility guidelines by all government websites, including training of web developers. Valuable insights gained from surveys can help shape strategies to improve current policies and activities for overcoming the digital divide.¹⁵⁰

6.11. Issues and challenges

Many challenges persist in the current education climate, ranging from inequalities in access, low quality of teacher training and curriculum, budget constraints, unstable political environments, local policy disconnects, lack of coordinated data systems to collect education statistics, and deficient childcare. A few issues and challenges within these areas are discussed below.

The majority of governments around the world still do not prioritize education in their national budgets. Education initiatives and institutions require significant resources to build up impactful education programs. If governments allocate less than the 20 percent recommended budget line to the education sector, many education policies likely will not be able to move forward. Additionally, governments still need to evalu-

Over the next 15 years, progress in SDG 4 will greatly impact the achievement of other SDGs. For example, the challenge of achieving health for all is fundamentally intersected with the challenge to achieve education for all.

ate their education policies with regards to local context, taking into account local languages and cultural differences.

As previously discussed, experts note that deficits in early childhood development can lead to lifelong debilities. The negative impact of deficient early childhood healthcare on education development is therefore a challenge that still needs to be bridged. Globally, one in four children are still short for their age—a sign of chronic deficiency in essential nutrients.¹⁵¹ A number of drivers influence school dropout rates, from broader contextual factors in the family or community, to teasing, bullying, interpersonal relationships and mental health.¹⁵² Holistic interventions that address these areas are therefore critical in achieving SDG 4.

Though the world has made great strides in advancing primary education for all, the challenge of post-primary education remains. The transition from primary to secondary school remains disparate, particularly for lower income families. According to UNESCO's Education for All report, in the Philippines, "69 percent of primary school graduates from the poorest families continued into lower secondary, compared with 94 percent from the richest households."¹⁵³

Another increasingly urgent issue is the challenge to provide education in conflict zones.¹⁵⁴ The dearth of trained teachers,

access to safe schools, and health issues all contribute to poor education in conflict zones. Continued advocacy, international action, as well as ICT initiatives such as remote learning, could be utilized as intermediary actions. However, the unique challenges of bridging the gaps around providing stable education in conflict zones still need innovative solutions.

6.12. Conclusions

Innovative solutions that employ ICT will be fundamental for empowering education leaders and communities to achieve the goal of SDG 4, Education for all.

Achieving SDG 4 will require collaboration between local, national and international stakeholders—both internal and external to the schooling system—with shared accountability and commitment to the common goal of universal, quality education.

ICT services for remote distance learning and teacher training, education data collection, and other cases discussed in this chapter will allow leaders and communities to address issues of access and inequality in attaining human capital for female, lower income, and special needs members of society. Properly evaluated ICT interventions can enhance the potential for a quality education by removing socio-economic constraints, opportunity costs, language of instruction, and preventing health deficiencies.

Greater focus on online learning must be matched with credible coursework certification to satisfy potential employers and ensure entry into further education. Numerous organizations are now attempting to provide credit equivalency or certificates for online programs for acceptance by employers.

The success of SDG 4 will depend on innovative, multi-stakeholder strategies to empower grassroots community leaders to address the compelling shortages of trained teachers and quality school curricula; to help curb dropout rates in secondary education by making it more affordable, practical and accessible; to improve access and quality of programs for early childhood development; and to remove socio-economic constraints—such as disparity in gender roles, poverty, opportunity costs of schooling, language of instruction and other inequities in educational opportunity based on ethnicity, local violence and conflict, or special needs of individual children.

6.13. Recommendations

SDG 4 calls for the dramatic scale-up of quality education from pre-K to secondary completion. This will be achievable only with a powerful and intensive use of ICT for education,

by 2020 or earlier. With early and immediate targeted interventions, education can be transformed and SDG4 targets achieved far more rapidly. Priority interventions include:

- (1) Connectivity of all schools, primary, secondary, and tertiary, to mobile broadband.
- (2) National teacher training in ICT equipment and applications.
- (3) Development of online curriculum in local languages as appropriate for lower levels, and national languages for upper levels.
- (4) Training of students in ICTs (computers, coding, ICT applications, etc.) at all levels of schooling.
- (5) Development of and access to existing online courses (MOOCs) for high-school and tertiary education, with accompanying print teaching materials.
- (6) Creation of free, online libraries with e-books, e-journals, e-magazines for use in all low-income countries.
- (7) Introduction of online monitoring of schools (teacher participation, student attendance, Internet usage, supplies and inventory management).
- (8) E- or mobile payments for teacher salaries and other Ministry of Education outlays.
- (9) Deployment of Community Education Workers (CEWs) akin to Community Health Workers (CHWs) to help schoolchildren in need.
- (10) Use of video-linked classrooms to extend the reach of the nation's best teachers and schools.
- (11) Online national testing of students at least once per year.
- (12) Real-time cloud-based policy dashboards for education managers, including school enrollments, attendance, and performance (including test scores).
- (13) ICT technologies for special needs, including voice recognition, online Braille, and others.
- (14) Scholarships for students from developing countries, including "vocational and information and communications technology, technical, engineering and scientific programmes" (Target 4.b).

