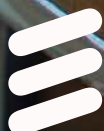


Technology-assisted education

Connect to Learn
multi-year, multi-country
experiences



ERICSSON

In
collaboration
with

Center for Sustainable Development
EARTH INSTITUTE | COLUMBIA UNIVERSITY

September 2018

Contents

Executive summary

02	Executive summary
04	Introduction
05	Overview of Connect To Learn's work
06	Recent developments in ICT-integrated education: Literature review
08	Making the SDGs a Reality – Insights from Connect To Learn
10	Focus area 1: Improving preschool and early grade local language literacy
14	Focus area 2: Improving gender parity in school enrolment through scholarships and skills training
16	Focus area 3: Raising the quality of teaching with digital learning resources and teacher development
19	Focus area 4: Preparing young people to be global citizens through school-to-school collaborative learning programs
22	Focus area 5: Providing adult literacy support for parents to assist their children in learning to read
23	Focus area 6: Improving access to alternative education opportunities for out-of-school youth
24	Connect To Learn's monitoring and evaluation framework
31	Looking ahead
33	Sustainability and scalability
34	About the authors

The world is now on board and has taken up the mission to work toward realizing the Sustainable Development Goals (SDG). Agenda 2030 is an ambitious set of goals that demand efficient strategies and deep commitment. Connect To Learn, which was founded almost a decade ago, has become a leading example with best practices for leveraging access to broadband in resource-poor schools globally. Connect To Learn is a public-private partnership between the Center for Sustainable Development at the Earth Institute of Columbia University (CSD), Ericsson and Millennium Promise (MP) and aimed at increasing access to secondary school – especially for girls – through scholarships, as well as improving the quality of education through life skills programs and integration of technology tools and digital learning resources in schools. Ericsson provides mobile broadband and cloud-based infrastructure, CSD provides exposure to cutting-edge research on education, and MP helps operationalize this research in under-resourced schools and their communities.

This report first situates Connect To Learn's interventions by summarizing recent developments in the field of ICT-integrated education. The literature review describes successful interventions along with their challenges. This section helps to highlight the current gaps needing to be filled in order to meet SDG 4 on education.

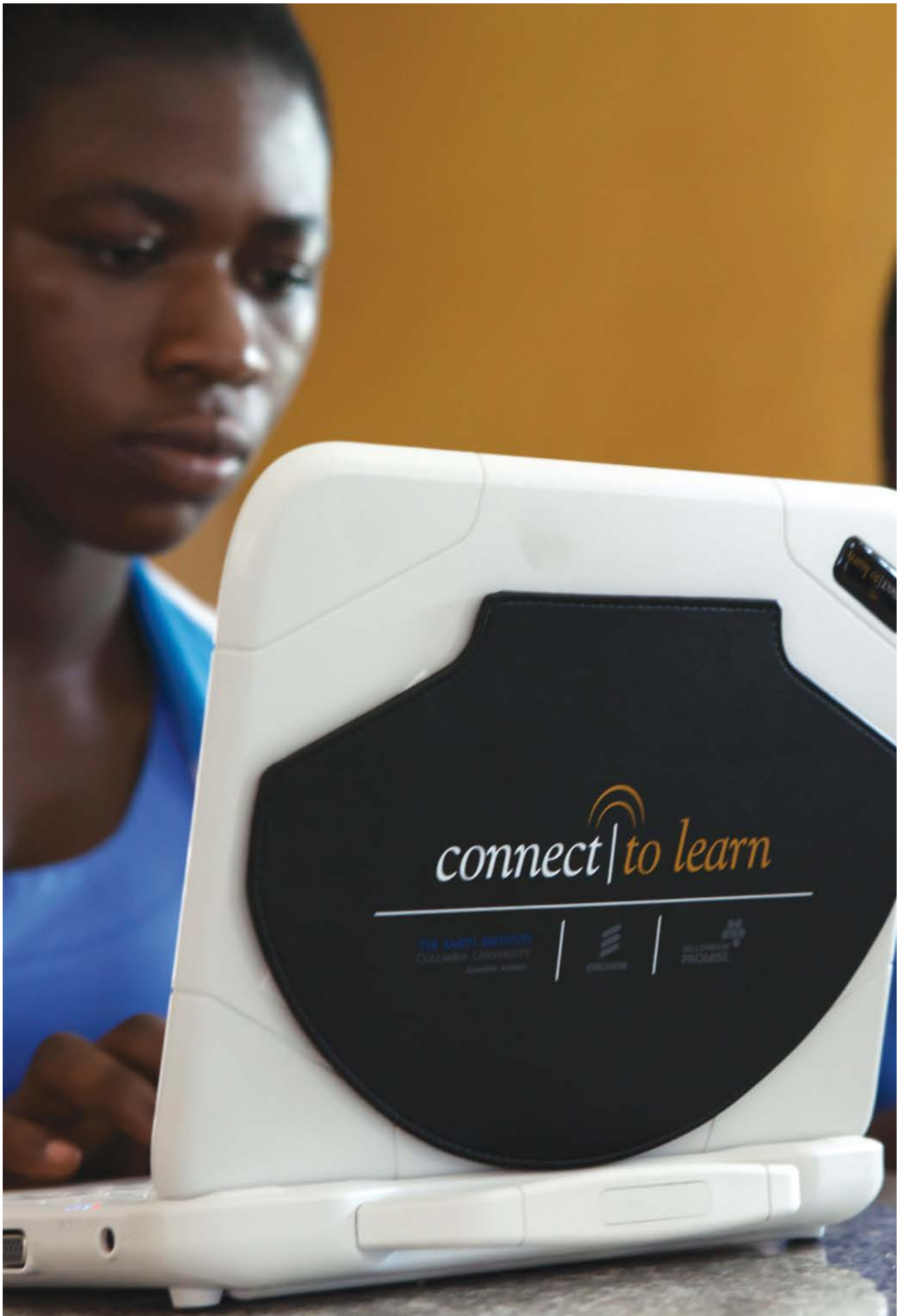
The following section presents the Connect To Learn approach and its evolution. It discusses potential focus areas in addressing the SDGs. Each focus area is substantiated from lessons from the field. Since Connect To Learn was first implemented in the Millennium Villages Project, the insights include many examples from the Millennium Villages sites in 10 sub-Saharan African countries. It also includes insights from scale-up operations in Myanmar and India. The following section

describes six focus areas. The focus areas span from early grade literacy to education beyond secondary school. Each focus area section includes examples of field-based interventions followed by an outline of the next steps. These focus areas are aligned to the SDG targets and provide clear pathways to achieving the education targets.

Connect To Learn uses data to make critical decisions regarding student learning outcomes. With recognition that data is key to tracking and meeting the SDG targets, the section also discusses the use of technology and data to be able to provide real-time feedback to improve program design and delivery.

The report concludes by outlining sustainability and scalability considerations. This section explains that electricity shortages and full 4G mobile coverage is still limited in rural parts of sub-Saharan Africa. Therefore, using renewable, solar-powered technologies will be more reliable. Working with existing site-based technologies, like smartphones, may provide teachers with the support needed. Relevant educational content and teacher professional development are the needs of the hour. Education could go beyond institutions and formal settings to be integrated into the daily lives of the communities through cyber-café or centers that provide educational content, IT skills and income generation for both students and centers.

Looking ahead, it is also acknowledged that new digital technologies are disrupting industries and changing the nature of work which in turn increases the demand for highly skilled workers. The Looking Ahead section of this report explores the necessity to provide opportunities to develop both basic and more advanced digital skills for school children, out-of-school youth and adults in even the most resource-poor settings, and looks at some of the key Connect To Learn initiatives focusing on digital skill development.



Introduction



Image source: MVP

SDG 4 for education aims to “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.” While this goal for education stands on its own, the team at Connect To Learn believes that education is the cornerstone around which all other SDGs can be achieved. A 2014 UNESCO report explains the multitude of ways that education helps enable progress in other sectors, including the role education plays in breaking the cycle of intergenerational poverty. Parents who are educated are more likely to enforce strong health and hygiene practices and provide nutritious food for their families. Children of educated mothers have lower child mortality rates, as educated mothers are more likely to give birth with a skilled birth attendant, to vaccinate their children and to understand how to prevent deaths from common

diseases. Women who are educated are more likely to get married and have a smaller number of children later in life, and are more empowered in the decision making which affects their own lives and those of their families, while educated men are more likely to wish to marry an educated woman and respect her rights.¹

The potential to transform delivery of quality education to the most remote corners of the world is larger than it’s ever been, thanks in large part to the rapid expansion of mobile broadband. Mobility, broadband and cloud are key technologies that place the mobile communications industry, in partnership with education and development experts, at the forefront of leading change to deliver quality education, and universal primary and secondary schooling. Connect To Learn was founded in 2010, and now after nearly

a decade, has become a leading example and provides best practices for leveraging access to broadband in resource-poor schools globally. Within SDG 4, there are targets to ensure all girls and boys complete free, equitable and quality primary and secondary education; to ensure access to affordable and quality tertiary education; to ensure all youth and more adults are literate and numerate; to increase the number of youth and adults with relevant technical and vocational skills; and to eliminate gender disparities at all levels. Connect To Learn’s work improving girls’ and boys’ access to quality education was grounded in these targets long before the SDGs were adopted. It is the intention of this report to illuminate the lessons learned through the Connect To Learn experience to help inform efforts being undertaken in the SDG era.

¹ UNESCO, Education for people and planet: Creating Sustainable Futures for All, Global Education Monitoring Report. (2016)

Overview of Connect To Learn's work

Connect To Learn was launched during the Millennium Development Goal era, when progress toward Millennium Development Goal 2 on universal primary enrollment was moving ahead year after year, and the problem of poor quality was emerging as the next big hurdle to overcome.

Despite the progress being made toward universal primary enrollment, it was observed in the communities of the Millennium Villages Project (MVP) – spread across 12 sites in 10 sub-Saharan African countries – that even as more students were completing primary school, higher costs and poor quality education led to a steep decline in the number of students transitioning to secondary school, especially among girls. It was this observation that inspired the launch of Connect To Learn in 2010, a public–private partnership of the Earth Institute, MP and Ericsson, aimed at increasing access to secondary school – especially for girls – through scholarships, improving the quality of education girls and boys receive through life skills programs, and integrating technology tools and digital learning resources in their schools.

Each of the three founding partners of Connect To Learn brought important expertise to the initiative. Ericsson helped launch Connect To Learn in order to optimize the impact of the mobile broadband technology it was enabling in the communities, together with Mobile Network Operators (MNOs).

The Earth Institute brought expertise in designing teacher training programs, learning assessments and systems for monitoring and evaluation, and MP provided links to schools, families and community leaders with their on-the-ground presence in the MVP communities.

Connect To Learn has, to date enrolled 791 students – the vast majority of them girls – on scholarships in the MVPs, with an additional 600 students in Myanmar, and has installed technology tools and connectivity in schools in 25 countries across four continents, reaching 120,000 students globally.

Scholarship recipients and their peers have received training from MVP staff in life skills, including health and hygiene best practices, prevention of gender-based violence, leadership, public speaking and gender issues, as well as vocational skills relevant to the local economies where the beneficiaries live.

A 2012–13 study on Connect To Learn's integration of information and communications technology (ICT) resources in schools in Kenya and Uganda showed that with ongoing teacher training and support for integrating technology in teaching practice, teachers' attitudes toward their own abilities for effectively using technology to enhance teaching and learning can improve, and their use of technology in teaching is more likely to increase. Since launching its ICT in education program in 2011, Connect To Learn has been working to improve delivery of the package of interventions necessary for ICT tools to be effectively used to enhance teaching and learning.

This package includes support for school-led development of an ICT integration vision; appropriate hardware and software tailored to the unique and challenging environments of remote schools with limited resources; curriculum-aligned, locally relevant digital education content; ongoing teacher professional development and support; and ongoing monitoring and evaluation. Lessons learned in Connect To Learn's early implementation in sites across sub-Saharan Africa have informed Connect To Learn's new, large-scale project in Myanmar, and other potential scale-up projects being implemented in countries across the globe.

Now with organizations and governments shifting their focus and alignment to the SDGs, Connect To Learn is well positioned to demonstrate how the SDGs can be implemented through tried and tested interventions aimed at improving the quality of education and young people's preparedness for livelihood through integration of ICT.

Recent developments in ICT-integrated education: Literature review

This section helps to outline the status of ICT-integrated education in the developing world. It presents the research around interventions and discusses the successes and challenges. Most education and development experts agree that ICT holds great potential for improving access to and quality of education for learners globally, and for achieving the SDG targets in education and other areas. As more new and promising technology-driven education initiatives are launching each year in developing country contexts, common understanding around the needs for context-appropriate hardware and software, ongoing teacher training and support, and locally relevant digital content are becoming more widespread, and new questions are being raised about the role formal schooling plays in student learning when new technologies are enabling new ways of learning. Numerous studies have pointed to the common barriers of ill-equipped teachers, the lack of training support and of locally relevant resources as major reasons for lackluster outcomes of ICT in education initiatives.¹ Research also highlights the impact ongoing teacher training has on increasing teacher uptake of ICT.² However there remains a dearth of robust evidence from developing country settings linking use of technology in education to improved learning outcomes, and identifying the nuanced details of what specific kinds of ICT solutions (hardware and software), teacher training, support, content and/or pedagogies most effectively lead to teacher uptake.

Most research into the impact of ICT on student performance that does exist comes from high-income countries, and within those countries, among middle-class and high-income populations. Several studies looking at students from more affluent schools with ample access to computers have found that

ICT holds great potential for improving access to and quality of education for learners globally.

technology-integrated learning can have a positive impact on learning outcomes.³ These studies tend to support claims that technology can facilitate self-led learning among students, but it must be noted that the students being studied in these cases are typically from more privileged backgrounds with access to computers at home and more pronounced independent study skills. Studies among low-income populations from high-income countries are less common; however these limited studies have shown that online learning for low-income students is most effective when supported by the guidance of a teacher as opposed to completely self-directed.⁴ Research has shown that low-income students get the most out of technology when used to explore and create, and when there is the right blend of technology and teacher interaction. Student self-regulation at secondary level in the US was not strong, since most students are not yet used to acting as independent learners. As a result, teachers implementing programs like Khan Academy typically need to intentionally orient their students to the types of independent learning practices and habits necessary for success using such ICT-enabled learning tools.⁵ This requires specific capabilities among teachers in how to adapt their teaching style to an ICT-integrated approach, and such programs also assume consistent access to resources like stable electricity and connectivity, and goes against common practices in low-income schools in the US, which more often encourage drilling of core concepts that

will appear on standardized tests. A barrier that many ICT in education pilots in developing country contexts struggle to overcome is relevancy of the content provided via the technology. As the international ICT in education community becomes more and more driven toward developing locally relevant digital content, more evidence will become available of how such availability of locally relevant content impacts student learning. One organization pushing this forward is onebillion, a non-profit publishing company that has developed a local language math app for early grade students in Malawi, aligned to Malawi's primary math curriculum. Results from a randomized control trial were published in 2015 and showed that after 8 weeks of tablet-based instruction for students in Standards 1–3, the treatment group in Standard 3 showed significantly higher performance gains than both a tablet placebo group and a control group who continued to learn through normal pedagogical practices. While the performance gains for the Standard 2 group were not as significant, they were still higher than the placebo and control groups. No significant differences were found for students in Standard 1, though it is important to note that the amount of time Standard 1 students spent using the tablets was less than the time spent by Standard 2 and 3 students. This study is important because it demonstrates the potential for tailored digital content to improve learning outcomes while also demonstrating that time using technology alone makes little if any difference unless accompanied by quality content, as the placebo group showed no significant difference in performance as compared to the control group.⁶ Another recent study in Tamil Nadu, India, looked at the impact on learning outcomes of a tablet-based intervention

¹ Aduwa-Ogieban & Iyamu, 2005; Brinkerhoff, 2006; Gunn & Hollingsworth, 2013; Adam, Butcher, Tusubira & Sibthorpe, 2011

² Hennessy, S., Harrison, D., Wamakote, L. Teacher Factors Influencing Classroom Use of ICT in Sub-Saharan Africa, *Itupale Online Journal of African Studies*, 2, p. 39-54 (2010)

³ Goldberg, A., Russell, M., Cook, A. (2003). The Effect of Computing on Student Writing: A Meta-analysis of Studies from 1992-2002, *Journal of Technology, Learning and Assessment*, 2(1); Gulek, J.C., Demirtas, H. Learning with Technology: The Impact of Laptop Use on Student Achievement, *Journal of Technology, Learning and Assessment*, 3(2) p. 1-38 (2005).

⁴ Darling-Hammond, L., Goldman, S., Zieleszinski, M. "Using Technology to Support At-Risk Students' Learning. (Stanford Center for Opportunity Policy in Education) (2014)

⁵ Research on the Use of Khan Academy in Schools; Research Brief, March 2014; "Research on the Use of Khan Academy in Schools," Robert Murphy, Lawrence Gallagher, Andrew Krumm, Jessica Mislevy and Amy Hafter, Menlo Park, CA: SRI International. (2014)

⁶ Pitchford, N. Development of early mathematical skills with a tablet intervention: a randomized control trial in Malawi, *Frontiers in Psychology*, 6(485) (2015)



providing locally tailored math, English and technology literacy learning content for grades 1–5. The program was implemented by Visions India in partnership with Mumbai-based tech company, Zaya Labs, beginning in 2016 and has engaged 2,260 students across nine schools. Pre- and post-intervention learning assessments showed a 4.87 percent increase in English performance and a 3.64 percent increase in math. The program also corresponded with a 70.2 percent reduction in absenteeism and a 68.6 percent reduction in students labeled by teachers as “slow learners.” Teachers also reported improved enthusiasm and participation among students, and improvements in their own technology skills and teaching capacity.⁷ While many small pilot-sized programs are being implemented by NGOs globally, ICT in education initiatives being implemented on a larger scale are mostly characterized by public–private partnerships. Private partners play a vital role in making ICT resources and support available, especially in low-income country and community contexts, offering the potential to help bring equity in access to quality education globally.

While more research is needed from developing country contexts, the research highlighted in this section provides a backdrop to the thinking that has gone into the ongoing design evolution that Connect To Learn has undertaken since its launch in 2010. As a public–private partnership working with some of the world’s poorest communities and least-resourced schools, it is critical that delivery of ICT in education interventions includes provision and participatory development of quality, locally aligned digital content; that teachers receive ongoing training and support, including technical support and device maintenance; and that all is done with full support and participation of the country’s education authorities. The role of ongoing monitoring and evaluation is also critical to ensure that programs being implemented are having a positive impact on participating teachers and students, since such programs can easily become a drain on resources that end up leading to little improvement in learning. The Connect To Learn strategy described in the next section is one that has learned from its early years of implementation and

the experiences of peers working in the ICT in education field, and applied these lessons to a more holistic, collaborative approach for the SDG era. Connect To Learn aims, through implementation of interventions described below, to meaningfully contribute to the much-needed body of research showing how ICT in education interventions can be designed to meet the unique needs of learners in developing country contexts and significantly improve their learning outcomes.

⁷ Visions Global Empowerment. Visions India e-Learning Program: Year 1 Impact Data Assessment (2017)

Making the SDGs a Reality – Insights from Connect To Learn

Connect To Learn's early strategy was designed to build on the work being done at primary level by Connect To Learn's partners in the Millennium Villages (MVs) to improve transition from primary education to secondary education for girls, and to improve the quality of education those girls and their peers receive through integration of mobile broadband-enabled technology tools in their schools. Prior to the launch of Connect To Learn, the MVP's work in education had been focused on MDG 2, achieving universal primary school enrollment. Ericsson's installation of mobile broadband in the MVs enabled the MVP education teams to use cell phones to track attendance data and learning outcomes, helping to detect learning issues and plan remediation measures on a regular basis. Broadband-enabled mobile data collection in the MVs was a pioneering innovation much before SDGs came about. Connect To Learn was launched to build on this success by addressing education quality and enrollment at the secondary level, two key foci of SDG 4 on education. As Connect To Learn has evolved and adapted through the lessons of implementation, the approach has become more holistic, identifying best practices for improving access to quality education through integration of technology tools and resources across the education continuum, from primary to secondary and beyond, and for learners both in and out of the formal schooling system.

Connect To Learn's interventions are designed based on the science and research of how children from resource-poor areas learn, to overcome the common barriers poor learners face in continuing their education and finding opportunities for work or further study upon graduation. Interventions are tailored to the needs of specific groups of children – particularly girls. ICT is not viewed as central to the program, but rather as a tool through which core goals aimed at improving quality and opportunity can be achieved. Connect To Learn's strategies have become more robust by incorporating field-based lessons. Embedded within the six key strategies outlined below is Connect To Learn's strong focus on digital skills development.

Connect To Learn's intervention focus areas for the SDG era include:

01. Improving preschool and early grade local language literacy, continuing to the strategic introduction of a second language in preparation for systems of education which change the language of instruction at the upper primary or secondary level
02. Improving gender parity in secondary school enrollment through scholarships and training in life, vocational, entrepreneurship, and digital skills
03. Raising the quality of teaching and learning through integration of digitally enabled learning resources and teacher professional development in secondary schools
04. Preparing young people to be global citizens through school-to-school collaborative learning programs
05. Engaging parents in the learning process of their children, by providing adult literacy instruction and support resources for parents to better assist their children in learning to read
06. Improving access to alternative education opportunities for out-of-school youth and adults

Collaborative partnership is a central component of Connect To Learn's approach. The above focus areas are only achieved through close collaboration between the three founding Connect To Learn partners, other local NGOs, ministries of education, in-country telecommunications industry partners and institutes of higher education.

Figure 1: Connect To Learn program alignment to SDG 4 on Education

4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes

Improve Grade-Level Learning of Literacy Skills - develop digitized materials, provide TPD, monitor student learning outcomes

Mainstream current out-of-school children into the formal school system through alternative education programs

4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable

Provide gender sensitivity training to teachers and community stakeholders to ensure that all students, regardless of gender are treated equally in their school environment

Develop gender sensitive curricular materials and guidance, and work with governments to integrate into formal curriculum

4.2 By 2030 ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education

Help governments develop policies and best practices for implementing quality early childhood education programs

4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university

Provide access to alternative education programs for youth, including technical and vocational skills programs

Develop apprenticeship programs with private sector partners. Connect learners to market opportunities

4.4 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

Provide ICT-integrated vocational skills and entrepreneurship programs in secondary schools and community centers for in- and out-of-school youth and adults

Establish school-to-work-to-university pipelines to help secondary graduates earn income to support higher education, e.g. as community education and health workers

4.6 By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy

Provide non-formal adult learning programs in literacy, numeracy, vocational and ICT skills in community centers equipped with ICT tools

4.7 By 2030, ensure that all learners acquire knowledge and skills needed to promote sustainable development, including global citizenship and appreciation of cultural diversity

Provide resources and teacher support for facilitation of the School-To-School Connections cross-cultural learning program

Integrate education for sustainable development into core curriculum through teacher training and development of materials

Focus area 1: Improving preschool and early grade local language literacy

The education teams working within the Millennium Villages shifted focus toward improving education quality and measuring learning outcomes in the middle of the MDG era, when it was observed that even as enrollment numbers rose, learning outcomes remained dismally low. Shortage of qualified teachers and learning materials stagnated learning outcomes, which in turn discouraged families from seeing the value of keeping their children enrolled. To address this, the education team began collecting monthly learning outcome data using cell phones and using the data to generate report cards that could be shared with schools, parents and communities. Ericsson technology made gathering student outcomes using phones in sub-Saharan African sites a reality long before SDGs were adopted. Smartphones helped to conduct rapid assessments to measure the “pulse” of reading and mathematics competencies among children. Even with very little training on technology, community education volunteers could quickly assess student outcomes and send the data through phones. The availability of 3G cell phone service, enabled by Ericsson’s installment of mobile network infrastructure in the Millennium Villages, helped the education

team to provide direct feedback to schools and their communities on students’ performance in near real-time. These were then churned into indicators and reviewed on a monthly basis. These indicators included student learning outcomes on local language literacy and basic mathematics skills. Indicators on school infrastructure included availability of clean drinking water, gender-separated toilets, adequate classrooms, meals provision, etc. The section on teaching aids included availability of teacher manuals, textbook availability and other teaching aids. Indicators were shared widely among all stakeholders including the local government, school inspectors, school principals, community and the MVP staff to plan remedial classes for the schools that needed assistance. The data also helped to track schools that had teacher shortages and discuss innovative solutions to the problem. Phones brought “data revolution” to some of the most rural, remote schools in sub-Saharan Africa.

Further leveraging the availability of mobile broadband in the Millennium Villages, from 2014 onwards, MVP sites used maps as part of the monthly monitoring of schools. For the majority of the sites, monthly performance monitoring indicators were collected to measure the progress of specific indicators. For instance, teacher attendance measured the number of teachers present in the school in any given day in the month and compared to the total number of teachers that needed to be present in the school. Similarly, in any two classrooms in the school, the enumerators observed student attendance in the sampled classroom. These indicators shown on maps were useful to observe school locations that had poor teacher or student attendance. The maps were easy visual tools to observe the schools in the cluster with attendance problems in order to inform program staff to address the issue with the school leadership.

Tracking Teacher Attendance in Mali

In Tiby, Mali, the schools that are in the rural parts of the cluster have poor teacher attendance. The maps helped to precisely show the school location that had this attendance issue (see map in Figure 2 below). The map helped to form the basis of discussion with the site teams on the rural, remote geography attributing to low teacher attendance in schools. The discussions yielded that the geography was a part of the problem. Schools were much more dispersed (in the north and south) than schools near the towns, therefore distance to schools may be longer for students. The discussions also suggested some structural issues that aggravated teacher absenteeism.

For instance, in Mali, full working days are Monday, Tuesday and Friday. But on Wednesday and Thursday, schools only open during the morning. Most of the absences were frequent on Wednesday and Thursday because many of the teachers used those days to take care of their personal and administrative responsibilities. The data helped the Education Coordinators to talk to district education officials about the teacher attendance issue. It was agreed that the government-appointed school inspectors would visit these specific schools and check on teacher attendance on a regular basis.

Another important monthly indicator is the students’ learning levels in basic literacy and numeracy skills. From all sites, a small sample of children were tested in each of the schools to get a sense of their literacy measures on a monthly basis. This was intended to help the school and the teachers to plan for remedial education based on understanding the gaps in the literacy measures. For instance, if the majority of the children tested were in the word recognition category, the teachers could focus on activities geared toward moving children from the word recognition level to higher level of readings – reading paragraphs and simple stories.

Figure 2: Connect To Learn Project Tibby, Mali

Proportion of enrolled students attending class at the time of the visit.

- 0%–12%
- 13%–45%
- 46%–75%
- 76%–90%
- 91%–100%

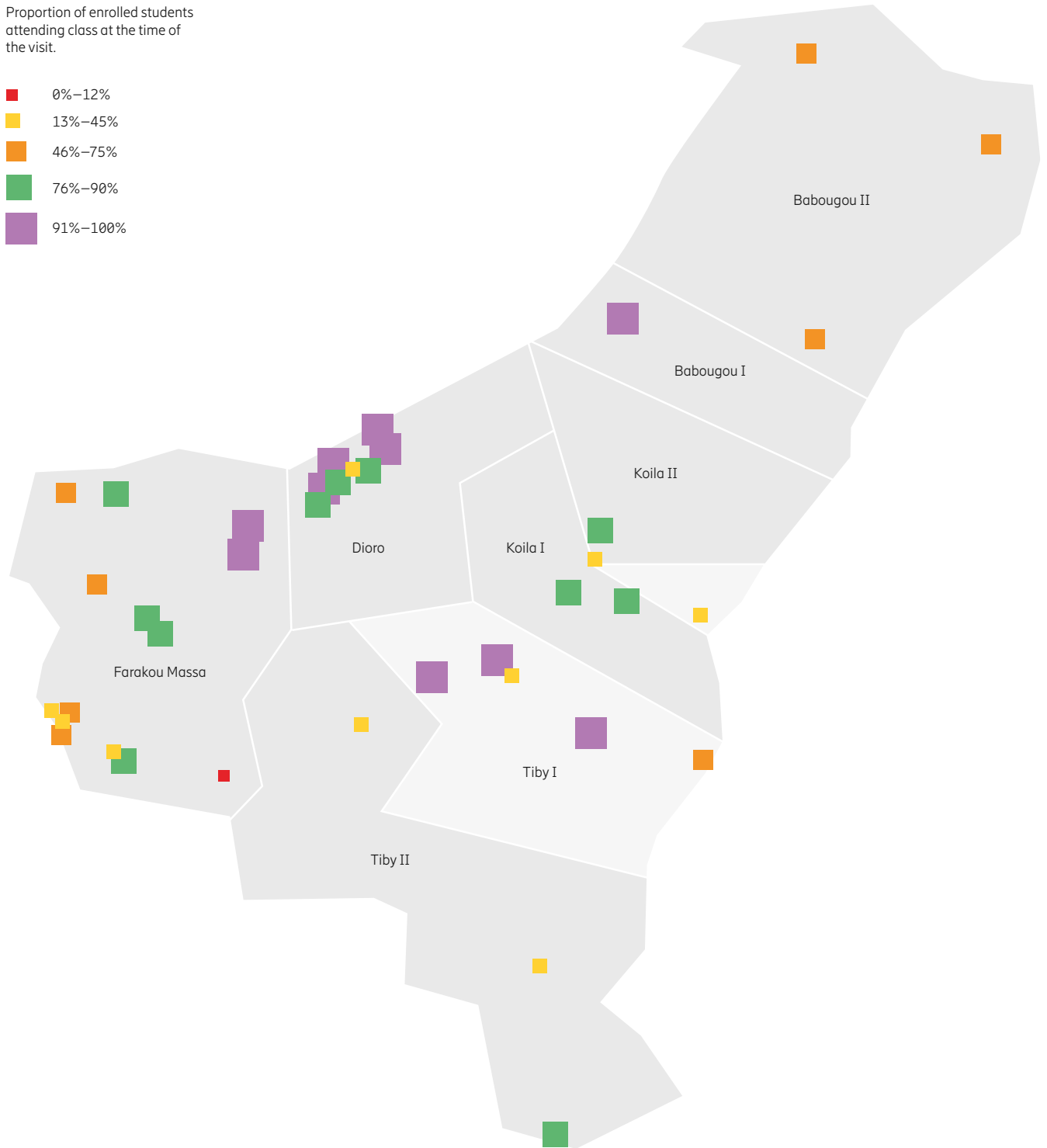
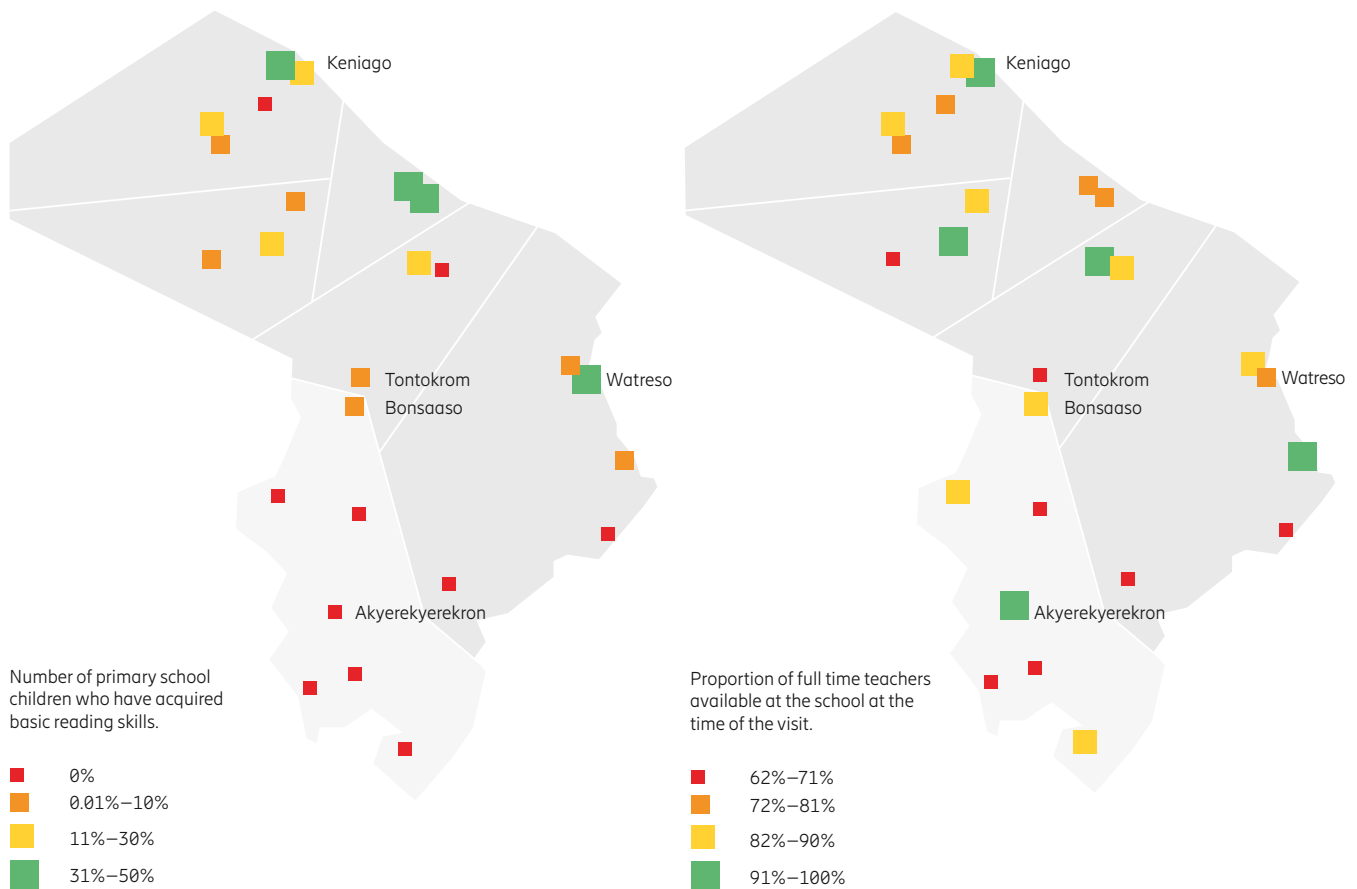


Figure 3: Connect To Learn Project Bonsaaso, Ghana



Addressing teacher shortage in Ghana

The monthly data depicted on a map from Bonsaaso, Ghana (Figure 3) suggested that the schools with a shortage of full time teachers also had low reading levels. Also, surprisingly, these schools were grouped toward the south of the cluster. Discussions with the Education Coordinator revealed that these schools were located in the remotest part of the Amansie West District. Due to the area's lack of basic infrastructural amenities, teachers were not accepting postings to those areas. Therefore, lack of teachers was one of the characteristics in that area of the cluster and the District as a whole. The few teachers who accepted postings to those areas were typically untrained. The data influenced the organizing of professional development programs for those teachers as well as helping to provide assistant teachers to temporarily fix the teacher shortage problem.

As part of Connect To Learn's overall strategy to improve the quality of student learning, Connect To Learn began working with literacy expert Dr. Helen Abadzi to develop an approach to teaching early grade local language that is rooted in the cognitive neuroscience of how children learn. Cognitive neuroscience research suggests that students, particularly in consistently spelled languages (the way you write is the way you speak), acquire automaticity most easily by starting from individual letters, combining them in increasingly large chunks, and getting plenty of practice in decoding them.¹ Feedback is an essential part of the process. Due to working memory capacity limits, students must attain a minimum reading speed in order to understand text. This means that for the students to comprehend what they read, they must read it fast enough. Slow readers forget what they read by the end of the sentence.

Students must become competent in quickly identifying individual letters and sounds, then composing them. Unlike in English, mere knowledge of letter sounds and practice in composing them reliably evokes words in consistently spelled languages.² In addition, letter spacing and fonts must be optimized, as suggested by USAID-sponsored research.³ A method of combining these elements should teach fluent and effortless reading to nearly all children. Connect To Learn works with education and linguistic experts to develop supplemental reading materials according to this approach, and trains teachers to focus on the sound each letter makes, spending a majority of class time facilitating individual practice and moving through the classroom offering corrective feedback to each student. Supplemental reading materials are designed to introduce letters one at a time, presenting them in order of the frequency with which they are used in the language as opposed to alphabetical.

¹Abadzi, H. Raising literacy from 20 percent to 80 percent?: A science-based strategy for GPE partner countries (English) Accessed. (2013)

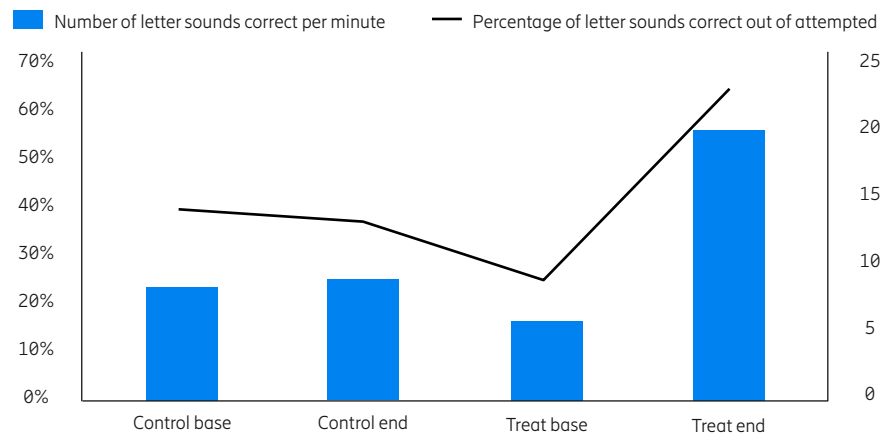
²Seymour, P. H. K., Aro, M., & Erskine, J. M. Foundation literacy acquisition in European orthographies. *British Journal of Psychology*, 94, 143–174. (2003)

³USAID, DeJongh, M. Best practices for developing supplementary reading materials (2014)

Case study: Early grade literacy in Mwandama, Malawi

The approach was first implemented in the Mwandama Millennium Village of Malawi starting in 2014. The reading workbook was developed by the MVP site Education Coordinators and the Primary Education Advisor (government-appointed staff to monitor schools) with input from local literacy experts over a period of three months. Because it was not possible at the time to integrate the approach into regular class time, the approach was implemented as part of an after-school program in community learning centers. The program engaged 29 Community Education Workers (CEWs) who were trained in the approach, and approximately 1,125 Grade 1–5 students. The CEWs were trained in the approach’s “I Do, You Do, We Do” method. For the “I Do” step, the teacher demonstrates the shape and sound of a letter and shows combinations with existing letters. For the “We Do” step, the teacher reads the new letter aloud along with students, ensuring that all focus on the target letter. The most important and longest step is the “You Do” step, where the teacher asks students to practice reading individually for at least 20 minutes of the class time, while the teacher walks by every student to give brief, individualized corrective feedback. The classrooms were regularly visited by the education team based in Mwandama to help support the CEWs in implementing the methodology correctly. Students in both the treatment group

Figure 4: Connect To Learn Project Mwandama, Malawi



and a control group were tested at the start and end of the intervention using adapted versions of four Early Grade Reading Assessment (EGRA) subtests in Chichewa, including knowledge of letter names, knowledge of letter sounds, fluency and comprehension. There were 112 students tested at baseline, and 90 retested at endline. The findings showed that, by the end, the treatment group could read 13 more letter sounds per minute than the control group, and could identify 62 percent of letter sounds, while the control group could identify 36 percent. Due to the emphasis on letter sounds during both teaching and training, the improvement in letter sounds for

intervention groups indicates successful implementation of the program. Students in the intervention group also read words more accurately than those in the comparison group. A report on the pilot’s findings can be found at: <http://redfame.com/journal/index.php/jets/article/viewFile/1504/1522>

Since the program’s initial success in Malawi, the approach has been extended in the Millennium Village of Mayange, Rwanda, and in CSD’s Model Districts Program in Telangana, India, where it is currently being scaled up with support from the district government.

Next steps

Looking forward, Connect To Learn is planning to integrate ICT-enabled resources to help improve teacher access to ongoing support and professional development for this approach to early grade literacy, as well as to increase students’ opportunities for review and practice of letter identification and reading. The Connect To Learn team worked with teachers in Telangana to collect footage of best practices and create a series of short videos demonstrating key pedagogical concepts. Connect To Learn is coordinating with teachers using the WhatsApp application that teachers

already use on their smartphones to share these videos and encourage communication among teachers. By using a blended model of teacher professional development, the need to pull teachers out of class for in-person training and associated costs are vastly reduced.

To help improve student practice, Connect To Learn has digitized its supplemental reading materials so that they can be made available on devices teachers and students can access at home, and has curated appropriately-leveled open source storybooks from African Storybook and Pratham’s Storyweaver,

including bilingual storybooks to help teachers facilitate transition to English as a second language. Connect To Learn is also in the planning stages of a partnership with the new teacher support platform Diksha, which is being rolled out in several Indian states in late 2018, and which aims to equip teachers with digital teaching and learning materials aligned to their textbooks through QR codes. The CSD education team is planning to conduct implementation research to support the rollout of this platform, and to advise on content creation and curation.

Focus area 2: Improving gender parity in school enrolment through scholarships and skills training

Enabling more girls to complete secondary education through scholarships, life skills programs, and access to quality learning resources using ICT was the founding mission of the Connect To Learn program. Since its founding in 2010, Connect To Learn has enrolled 774 girls on multi-year scholarships in the Millennium Villages, and another 600 girls in Myanmar. The scholarship program was designed to select girls based on a combination of need and merit through a community-led process that engaged community leaders, school principals, teachers, and parent leaders in the selection of scholarship beneficiaries. From the beginning, the scholarship budget was set at a level that could allow funding not only of school fees, books and uniforms, but also the supplies necessary to focus on school, such as bicycles for safe transport and feminine hygiene products. Further, the scholarship budgets were designed to support extra-curricular programming including life and vocational skills programs.

Each Millennium Village education team was encouraged to develop their own programs based on the needs and interests of the girls involved in the scholarship program. In Ruhira, Uganda, Sauri, Kenya and Bonsaaso, Ghana, girls went on an annual learning tour to their nearest cities to visit universities and meet with women entrepreneurs. In Mwandama, Malawi, the education team organized a camp for the girls over their summer holidays, during which time they explored topics relating to girls' empowerment and received intensive training in using the computers provided by Connect To Learn.

As Connect To Learn scholarship students began graduating, the team developed a graduate tracking survey to get a sense of the next steps of recent graduates. Again, leveraging access to mobile broadband, the MVP education teams used cell phones to collect this data from recent graduates. The findings showed that many were still struggling to find employment or to finance their higher education. In the Savannah Accelerated Development Authority (SADA) area of northern Ghana, the survey found that among girls who graduated from senior high school in 2015, 94 percent had not



Image source: CSD

enrolled in a higher education institution or other education/training program five months post-graduation, while 71 percent remained without employment. Of those employed, 60 percent were only employed part-time. Even with a secondary education, many girls graduate into economies ill equipped to offer them meaningful employment opportunities, and systems that lack mechanisms to help enable a higher education for those who lack the family financial support to pay for it. These findings drove Connect To Learn to put a stronger focus on developing girls' vocational and entrepreneurship skills while still in secondary school, as a way to help them save to pursue a higher education or provide a foundation for a successful career as an entrepreneur, and possibly both.

Connect To Learn teams working in Pampaida, Nigeria; Mayange, Rwanda; and Sauri, Kenya, have led the way in establishing vocational and life skills training for girls on Connect To Learn scholarships in their schools. Starting in 2014, the education team at the Pampaida Millennium Village Project has organized vocational skills workshops for 90 scholarship beneficiaries. The girls have been able to use their new skills to earn income to support their secondary education and save for higher education after graduation. These programs have had a positive impact in the community beyond the girls directly – for example, the Millennium Village team has purchased soap from the girls for distribution to the area primary schools to support their school sanitation programs.



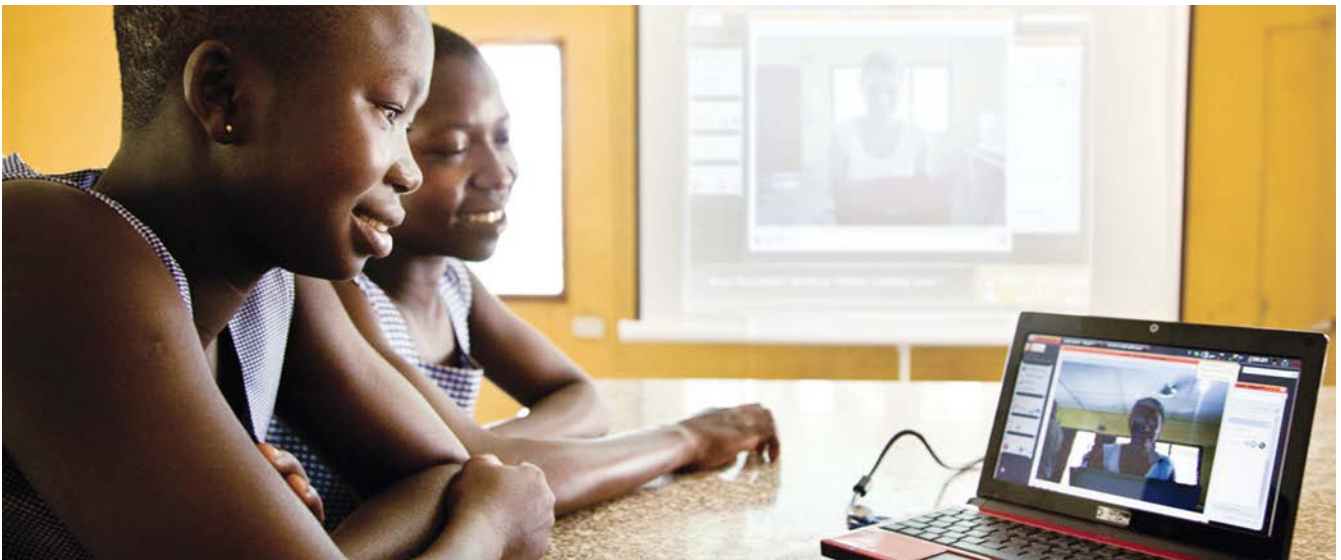
Image source: CSD

As the girls in Pampaida have further developed their skills, they have formed a cooperative to operate their business, and opened small shops on the school grounds where they sell their goods to the community. To further grow their skills, the team in Pampaida has partnered the girls with the Center for Learning, Development and Advocacy (CLEDA) in nearby Zaria, where girls have received training from local experts. The vocational training modules include skills in:

- Making skin and beauty products including soaps, lotions, and perfumes
- Cloth tie and dye and tailoring
- Jewelry design
- Candle making

In Rwanda, 37 girls recently graduated from secondary school have received vocational skills training in tailoring and weaving while also receiving business, financial literacy and digital skills training with support from Connect To Learn. The group of trainees has been equipped with a smartphone and some basic training in marketing photography. They are using the phone to communicate with buyers and promote their products through platforms like Instagram. The Connect To Learn team is also helping to connect the young women to market opportunities beyond their home communities, training them to learn how to use platforms like Western Union to do business with clients abroad. It is expected that some of these girls will use funds earned through their business to finance their higher education or grow their businesses.

Case study: Supporting girls' entrepreneurship with e-Mentoring



In September 2016, Connect To Learn launched a new partnership with Salesforce to connect girls in Pampaida to women mentors using Skype. The Connect To Learn team worked with Salesforce's Volunteer Coordinator to generate interest among Salesforce staff, and then worked with the volunteers to develop a series of sessions relevant to the expressed interests of the scholarship students. The students in Pampaida met monthly with a diverse group of women from Salesforce to discuss topics ranging from time management, to balancing responsibilities at home, school and work, to costing and marketing for their products.

By working with e-mentors from different parts of the world, the girls were challenged to envision how their young businesses could attract new customers, both within their own communities and internationally, and were guided in the creation of business plans, marketing strategies, and costing of products. One Connect To Learn scholarship student, who is the acting President of the Connect To Learn Scholars Cooperative Society, said of the e-mentorship program, "The ideas and skills that we acquired from our interactive sessions...will continue to play significant roles in improving our lives and we will continue to be guided by them."

The e-mentorship program continued in the 2017–18 academic year with a new group of students in Pampaida, and a group of students in Mayange, Rwanda. The women mentors at Salesforce are also working to deepen their partnership with Connect To Learn by organizing opportunities to purchase products being made by the girls they are mentoring to help them reach new markets and to raise funds for their business development.

Next steps

Looking forward, Connect To Learn is working to digitize vocational skills training modules as part of the Connect To Learn digital platform provided in schools, and to create content that links core curriculum concepts to vocational skills that are relevant to students' everyday lives and help connect new academic concepts to students' prior knowledge. A set of such e-learning modules is currently being produced to address core concepts in chemistry and physics through the teaching of indigenous practices in shea butter extraction, soap production and recycled

glass bead making that are common in Ghana and other parts of West Africa.

Provision of vocational and digital skills and entrepreneurship training content will be part of the Connect To Learn platform going forward. As students gain skills, Connect To Learn will emphasize connecting the young entrepreneurs to markets domestically and internationally, including through digital marketing strategies that help the learners to develop their digital skills. Availability of mobile broadband in the project communities will help facilitate this effort by enabling

students and graduates to participate in vocational skills and entrepreneurship e-learning programs, and to engage in online banking and e-commerce to expand their access to markets.

Connect To Learn will continue to use cell phones to track the outcomes of its scholarship graduates in sub-Saharan Africa and Myanmar in order to measure the impact the vocational skills training has on their likelihood to enroll in higher education and/or find employment after graduation as compared to their peers who did not participate in such training.

Focus area 3: Raising the quality of teaching with digital learning resources and teacher development

When Connect To Learn was launched in 2010 to leverage mobile broadband for improved quality education in secondary schools, conventional wisdom informing new ICT in education programs often assumed that with access to devices and broadband connectivity, remote, resource-poor schools could be transformed through access to the world of learning resources available online. Connect To Learn's initial technology solution was designed accordingly by partner Ericsson, with a lab of 25–50 netbooks optimized to work on low bandwidth and with a Linux operating system intended to eliminate the work of virus protection and software updates for teachers and students with little if any experience using ICT. Early lessons taught us that even these initial design features still proved to be user-unfriendly for teachers new to ICT, and that continuous teacher professional development and support was absolutely critical for teachers to take up using ICT tools in their practice, especially if they are expected to evolve their pedagogy to facilitate more interactive lessons with students.

Connect To Learn has been pioneering technology to make instructional time use more efficient in classrooms. Locally adapted technology was offered to classrooms that lack electricity and technical expertise. Connect To Learn found that the technology is viable, and with constant technology improvements, its technical sustainability will increase. First-hand learning from classrooms helped the technology delivery model to continuously be molded. For instance, teacher kits and student tablets supplemented the traditional laboratory-based model. Similarly, more western e-learning content gave way to localized national Ministry-approved content.

To address early challenges, a one-year Collaborative Action Research (CAR) study was conducted in 2012–13 to deepen understanding of how ICT tools can best be implemented in secondary schools in resource-poor settings. Secondary schools in Uganda and Kenya were intensively studied during the year-long engagement. Working together, senior education researchers from the

Connect To Learn has been pioneering technology to make instructional time use more efficient in classrooms.

University of Nairobi in Kenya, Kampala University in Uganda and Teachers College of Columbia University in New York addressed some of the most apparent gaps and obstacles in four schools over the course of the project through:

1. Implementation of ongoing Teacher Professional Development (TPD)
2. Adaptation of critical elements of infrastructure needed for successful ICT integration in classrooms
3. Collection and sharing of relevant online teaching and learning resources and collaborative tools
4. Identification of key next steps for successful and sustainable integration of ICT at project schools

A key finding was that without a school vision for the integration of ICT tools and an enabling environment that encourages use of ICT tools in classrooms, there was little hope of uptake. As teachers' skills increased, their perceived barriers to ICT integration in teaching shifted: at baseline, 37 percent identified lack of skill as the biggest barrier. By endline, only 4 percent of teachers listed this as the biggest barrier, the majority pointing instead to infrastructure challenges and reliable internet access.

Weak connectivity was a key hindrance to teachers finding online resources, pointing to the need for school servers populated with resources to be used as a supplement to Wi-Fi routers. Most importantly, the experience showed that the process of building confidence and skill and commitment of teaching staff takes persistent effort over time.

Through the CAR study and since, Connect To Learn has learned a lot about the pieces that need to be in place to effectively integrate ICT in classrooms,

and has continually worked to refine its technology solution and training approach to meet the unique needs of remote schools with limited access to broadband. During an April 2016 visit to the two Connect To Learn schools in Mayange, Rwanda, the Connect To Learn team had a chance to put some of the lessons and evolving theories of what can work to the test in collaboration with our local team and teachers at the schools. The team tested a "whole-class" model of using ICT, using one teacher computer, connected to a projector and interactive whiteboard, and a local server pre-populated with curriculum-aligned content. Teachers were trained in using the interactive whiteboard to facilitate lessons and provided recommendations for additional content to be added to the servers. The week following the training, teachers began using the server content with the interactive whiteboard in their classes. As teachers navigated through their content and students came up to fill in answers or offer their input, the intuitiveness of this whole-class approach was clear. Even with just one computer being used in the lesson, the interactive whiteboard enabled many students to interact with the computer interface, helping to build not only their subject content knowledge, but also their ICT skills, as well as without requiring individual student devices. After the morning demonstration classes, the students who had participated erupted with excited questions, asking how the interactive whiteboard pen communicates with the computer, and what other content they'll be able to find on the server.

A chemistry teacher at Kamabuye Secondary School who used the interactive whiteboard and server content to teach a lesson noted that the approach is "very attractive to the students...it is hard to understand chemistry if nothing is shown, if we show them pictures and videos they understand more." A biology teacher said that ICT "facilitates both the teaching and learning process...students can see exactly how certain biological processes happen." Because of these promising test cases, the Connect To Learn team strongly recommends that interactive whiteboards and offline servers



Image source: CSD

be included in future school installations in settings facing similar challenges of weak connectivity, teachers inexperienced with ICT, and large class sizes.

Aside from identifying a technology solution that works, a key component to the success of any ICT in education initiative is the availability of relevant content. Connect To Learn has worked to enable access to relevant content by developing Connect To Learn's Resource Library housed on the Connect To Learn website, and by developing an MDG curriculum, which includes lessons in four core subject areas – language arts, civics, sciences, and math – aligned to each of the eight MDGs. Once it was learned that slow connectivity was a significant barrier in most sites, the Connect To Learn team began organizing libraries of open source content according to country curriculums that could be housed on local servers, making the content available offline. These servers populated with curriculum-aligned content libraries have so far been rolled out in the Mayange, Rwanda Millennium

Village as described above, and the Mbola, Tanzania Millennium Village. Connect To Learn plans to continue rolling out this package in all of the sites where Connect To Learn operates.

Connect To Learn's foundational series of teacher professional development modules are designed to model methods of interactive teaching, including brainstorming, group work, learner demonstrations, individual work and peer review. The module topics include:

- ICT-integrated teaching and learning
 - basics of using ICT devices
- Creating learner-centered, gender friendly lesson plans
- Making effective use of online/digital resources
- Creating slideshows for classroom teaching
- Using spreadsheets for classroom and school management
- Using communications tools and collaborative learning platforms

Teachers will be trained in how to use open source tools, such as African Storybook to adapt reading materials into different languages.

Once teachers reach a necessary level of proficiency using the devices and facilitating interactive lessons, the focus of training will shift to content creation and adaption. To streamline with Connect To Learn's early-grade literacy interventions, teachers will be trained in how to use open source tools, such as African Storybook to adapt reading materials into different languages, including how to facilitate student projects for doing the same. Connect To Learn's approach to teacher training has involved collaboration between the three Connect To Learn partners and the schools. During the MVP school ICT installations, Ericsson provided basic ICT training to the teachers, and going forward, CSD worked with MVP education staff and lead teachers from the schools to develop the training objectives, content and training approach. As the technical advisory partner, CSD led these training development efforts, but encouraged MVP education staff and teachers from the schools to take leading roles in the training itself, in order to build local capacity for ongoing training efforts.

Case study: Filling the teacher shortage gap in STEM subjects with help of ICT in Mbola, Tanzania

At 17 years old, Irene Tamson is among the best girl students in science subjects across the Tabora region of Tanzania. Irene attends Lolangulu Secondary School, one of the first schools to launch Connect To Learn after its founding in 2011. To address the need for curriculum-aligned content to improve the quality of learning, especially since connectivity in Tabora was limited, Connect To Learn partnered with Studi Academy in 2015 to implement a curriculum-aligned e-learning program in STEM subjects. The program, which was designed by Studi in collaboration with the Tanzanian Ministry of Education and Tanzanian teachers, includes videos and assessment quizzes in physics, chemistry, biology and math for Form 1 and 2 (the first two years of secondary school), with plans to expand to more grades and subjects. Connect To Learn, through partner Ericsson, provided Android tablets to be used to access the Studi platform. Connect To Learn also provided the school with a Critical Links C3 server, loaded with offline materials to make e-learning possible even when connectivity is limited or unavailable, as well as teacher training. Teachers have reported that the program has helped them identify where individual students are struggling, while students have reported that the program has helped them continue in their studies even in cases where teachers are absent or where certain subjects lack teachers altogether.



Irene Tamson completes an assessment quiz on her tablet at Lolangulu SS. Image source: MVP

“Studi Academy helps me to do my homework and learn new things and corrects me instantly after doing my quizzes.” – Irene Tamson

Lolangulu Secondary School is one of 18 secondary schools in the Uyui District of Tabora Region. After the Form 2 examinations in 2016, Irene’s performance placed her at the top among girl students in the entire district, and she alone was selected to represent the district at the Tabora Region student science competition. Irene’s performance is, of course, testament to her commitment to her studies, but also demonstrates the potential Connect To Learn and Studi’s

e-learning program has for student learning in STEM subjects, considering the reality that Lolangulu Secondary School has had no teachers for math or physics for two years, and has insufficient teachers in chemistry and biology. The headmaster of the school, Cleophas Bugombo said “The school lacks science teachers, but with availability of the e-Learning Platform at the school, to some extent it has reduced the gap for science teachers.” Students like Irene are excelling in STEM subjects thanks to Connect To Learn and Studi’s e-learning program.

The Connect To Learn Coordinator and Social Studies teacher at Lolangulu Secondary School, Hans Kimilike, goes above and beyond to make sure that teachers and students are registered and trained to use the technology in their teaching and learning. He explains: “We register them online and train them on how to use the e-learning platform and students are now busy, show interest and feel free to study science subjects while interacting with tablets. We also constantly use the C3 server for online and offline connection.” Since Lolangulu’s e-learning program has led to such impressive performance among students, its reputation as a school offering a quality education in the region has grown, helping to contribute to improved retention and enthusiasm among teachers. The school is currently working to recruit teachers for math and sciences.

Next steps

Looking forward, Connect To Learn will be rolling out a content management platform, developed by Ericsson, that will make it easier for teachers to identify and organize content relevant to their subjects and grade levels. The technology solution will also be supplemented with the local content servers to enable access to offline content, so that ICT integration can be seamless in cases where connectivity is unreliable. The CSD education team will also work with Ericsson to develop

a series of content that helps teachers connect core curriculum content in the sciences to common vocational skill areas familiar to students, in order to help the students tap into prior knowledge for better understanding of complex concepts (e.g. the chemistry of soap making). This content will tie into Connect To Learn’s work developing vocational training programs for youths. Connect To Learn is also working to develop a blended learning platform for teachers’ professional development to

help make it easier to follow up and refresh their training between in-person sessions. This professional development content will include videos of pedagogical best practices for integrating ICT and learner-centered methods, sample lesson plans and resources. Modules on cyber wellness will also be included to help teachers build healthy digital skills among themselves and their students, such as knowing how to protect themselves against cyber-bullying and identify valid online sources.

Focus area 4: Preparing young people to be global citizens through school-to-school collaborative learning programs



Students from Global Kids in New York City discuss solutions to plastic waste with students from Rwanda over Skype. Image source: CSD

Connect To Learn's School-To-School Connections program is designed to connect classrooms from different corners of the globe to foster collaborative learning, cross-cultural understanding, and global awareness by leveraging technology and the internet as tools for bridging classrooms. The program helps partner classrooms to create and adapt lessons that integrate use of collaborative online learning platforms, video conferencing, audio calls, emails and other technology tools to facilitate cross-cultural exchange that helps students and teachers illuminate the commonalities and distinctions between each other's lives. Connect To Learn supports these collaborative learning projects by identifying interested schools, and works with them to determine which potential partner schools will be the best match for their learning goals and logistical needs, and to develop lesson plans that connect the learning goals and curriculum content of the two partner schools.

Exchanges include connections between schools in the US and schools in Ghana, Uganda and Malawi. A recent project between a school in Massachusetts

"The Connect To Learn program...has opened our minds to our global citizenship potential."

and Mansoman Senior High School in the Bonsaaso, Ghana Millennium Village, has engaged students in exploring literature from each other's countries that explores themes of segregation, colonialism, and democracy. One student from Massachusetts said: "The Connect To Learn program...has opened our minds to our global citizenship potential. It has become an inspirational source of knowledge about school, literature, and life in Ghana. One of the most interesting discussions we had with our friends at Mansoman was about the political systems of our two countries, and how democracy is manifested." A 2017 collaboration between St Anthony Secondary School in the Mwandama, Malawi Millennium Village, and a school in Cologne, Germany, led students through the exploration of the SDGs. The students focused on three main areas of the SDGs, including extreme poverty, fighting

inequality and injustice and addressing climate change. Students explored these MDGs as homework between sessions and shared their findings with each other. During the Skype sessions, students asked each other questions about their daily lives, their cultures and religions. One student in Cologne, Germany, explained: "This workshop really helped me to be a better global citizen."

In July 2018, students from the Global Kids program in New York, and students from the Connect To Learn program in Rwanda connected for a discussion on the dangers of plastic waste to our eco-systems. Rwandan students discussed their country's experience of banning plastic, offering advice for how students in New York could help advocate for similar measures in their city.

Case study: Every year, two schools from across the globe celebrate World Read Aloud Day



Students from Connecticut reads to her peers in Tanzania for World Read Aloud Day. Image source: Kristen Ball

Connect To Learn's longest-running school-to-school partnership, ongoing since 2011, is between Lolangulu Secondary School in Tanzania and New Canaan Country School in Connecticut. The partnership has been successful due to the passions of the two educators coordinating on each side – Kristen Ball, a teacher from New Canaan Country School, and Nemes Coleman Temba, the Education Coordinator from the Mbola Millennium Village in Tanzania. Every year, the two schools meet over Skype to celebrate World Read Aloud Day, a worldwide effort to raise awareness of the need for global education, and to celebrate the power of literacy. World Read Aloud Day is meant to motivate children, teens, and adults to celebrate the power of words, especially those that are shared from one person to another.

For this collaboration, Connect To Learn facilitated hour-long Skype video calls for students at Lolangulu Secondary School and students at New Canaan Country School to share stories representative of their respective cultures and practice reading aloud in both Kiswahili and English. A reflection on one of these sessions from New Canaan Country School teacher Kristen Ball is highlighted below:

By 8:15 am (4:15 pm in Tanzania), the 26 students in Kristen Ball's class at New Canaan could hardly contain their excitement. The 5th and 9th graders and their teachers waited eagerly for the Skype call to come through from Mbola. The faces of the students in Mbola were visible on the computer and projected on a big screen. The students on each side clapped and immediately exchanged greetings. They could not

stop giggling and waving to each other. Kristen Ball then introduced her class, thanked the teachers and students in Mbola, and highlighted the incredible opportunity it was for the two groups to share their readings with each other.

Jack Megrue, a 5th grade student, then sat close to the computer and read *Of Thee I Sing A Letter to My Daughters*, by Barack Obama. Jack talked about the former president, how he is from Kenya, not too far from Tanzania, and how they hope that Obama will bring the countries in the world closer together. For about eight minutes, the students in Tanzania quietly listened with a lot of interest.

The students at Lolangulu then read a short story about Mount Kilimanjaro located in northeastern Tanzania and the highest free-standing mountain in Africa at 19,341ft above sea level.

"I will remember how a seven-year-old said, if she could have anything in the world, it would be 'No more war. Peace.' I will remember that because that is not what popped up in my head but that is what should have."

– Wyatt, 5th grader

"The thing I will remember the most is the girl who answered the question: 'If you could have anything in the world, what would it be?' The girl thought and then answered: 'No more war. Peace.' I will remember it because, even though she was only seven, she wished for something for everyone."

– Emily, 5th grader

"I will remember that for one moment in time, we were connected with people all the way across the world. I think we will both remember how different we are but how we are still the same. We let them into our culture and they let us into theirs. We saw how their lives are and they saw how ours is."

– Meghan, 5th grader

"All people should have the right to an education. Kids who have done nothing but good things in their lives deserve a chance at an education. An education is important because it is like the invention of the printing press – it spreads ideas and understanding, which leads to discoveries and all sorts of advancements."

– Kate, 6th grader

They are proud of this beautiful snow-capped mountain that attracts many worldwide tourists and is the main source of revenue for the country.

There was singing, laughter and instant clapping after every question and answer, and waving to each other as each student made their way to the computer video camera to ask a question or answer one.

Although there are similarities and differences between the students on either side, it was particularly interesting to see the expressions on their faces during the Q&A. Kristen Ball's class grew teary as the students in Tanzania explained that they walk for so long to fetch water and walk one and a half hours to school every morning. One student in Kristen Ball's class said: "We are really lucky." One of the teachers also thought that seeing each other's faces removed a big wall and enabled the students to interact on a personal level. Within one hour, the students were talking to each other with ease as though they had known each other a long time.

We all did not want to end the call, but had to say Kwaheri (good-bye in Swahili, the national language for Tanzania) to each other as Kristen Ball thanked the teachers and students in Lolangulu.

This is an important milestone in the School-To-School program, which seeks to connect classrooms in the US with classrooms in rural Africa. Enabled by internet access, students connect and interact in real-time, increase their knowledge of other cultures and traditions, and improve their ability to think analytically and creatively about global issues. Although these two groups of students are from different cultural backgrounds, they were able to interact productively, and share in their differences and similarities. It is the beginning of a great friendship, but also a strong School-To-School connection.

A few reflections from the New Canaan Country School students are given above.

The schools have engaged in additional collaborative projects, including a project in 2013 whereby students explored issues of gender inequality, and wrote and recorded song verses to sum up their discussions, which were then edited into a song by one of the teachers.

Next steps

As the School-to-School Connections program has matured, collaborations have become more curriculum-aligned, with the CSD education team supporting partners with lesson plans and resources to help bridge the curricula of the two partner schools. To build on this, Connect To Learn is exploring opportunities to formalize the School-to-School Connections program by working with schools and school districts in the US that have a global citizenship emphasis.

Focus area 5: Providing adult literacy support for parents to assist their children in learning to read



Image source: CSD

The CEWs model was instrumental in mobilizing community-level education efforts to target school enrollment, remediation and school completion. While the range of activities CEWs conducted varied significantly across the Millennium Village sites, their main roles comprised of: identifying and following up with out-of-school children; supporting data collection and validation of data on school participation, retention, completion, gender issues and secondary school transition; monitoring education indicators including basic literacy and numeracy levels; mentoring and counseling parents and children at household and school levels.

To understand the learning progress of students and the school environment more qualitatively, monthly data collection was conducted using mobile phones with the surveys directly housed on the phone as an Android application. The questions pertaining to the availability of teaching and learning materials, teacher presence, pupil-to-teacher ratio, teacher training on literacy and numeracy as well as students' basic literacy and numeracy levels were captured in the data. Using cell phones for the data collection enabled the CEWs and Education Coordinators to input data digitally during the visit to the school and save their data on the phone, enabled by the wireless cellphone towers. Mobile data collection enabled real-time data analysis, allowing quicker and regular monitoring of the status of classroom learning as well as school inputs to learning.

Next steps

Connect To Learn plans to build on the CEWs program by integrating technology and training them to equip families with strategies to support the learning of their children. CEWs will be equipped with tablets that have digital local language and bilingual storybooks on them adapted from the open source content from African Storybook, so that CEWs can train parents in helping their children to practice reading, even for parents lacking literacy skills themselves. Through the process of parents' learning to better support their children's studies, parents will develop their own foundations in literacy and digital skills.

Focus area 6: Improving access to alternative education opportunities for out-of-school youth



Connect To Learn scholars participate in a tailoring training during the break before their final year of secondary school. Image source: MVP

Next steps

Connect To Learn is partnering with the District Collector's office in Mahbubnagar, Telangana, India to launch a solar-powered ICT center targeted toward youth and adult women, which will offer classes in digital skills and conversational English as well as workshops in entrepreneurship, financial literacy and topics to help break down gender stereotypes and equip women with life skills to develop and pursue their personal and career goals. Training tracks will be aligned with input from local business leaders on the skills gaps they need to fill. A location has been identified and is planned for launch in late 2018.

Connect To Learn is working to expand its technical and vocational training programs to reach out-of-school youth as well as the in-school youth the programs currently serve. Connect To Learn has recently conducted needs assessments to better understand the needs of youth in some of the project countries, including Myanmar and Ghana, and will use the findings to adapt existing programs and identify content that can be used to teach the necessary skills for effective livelihoods. In the Myanmar needs assessment, English language and ICT skills emerged as priority areas among the youth, teachers, NGO and government officials surveyed. In Ghana, priority areas include shea butter processing and production of natural skincare products, weaving and tailoring, woodwork and glass art.

Skill areas being planned for inclusion in Connect To Learn's programs for out-of-school youth include:

- Digital skills
- Financial literacy
- Remedial adult literacy and numeracy
- Entrepreneurship and business planning
- Specific skill areas based on demand in project communities

Connect To Learn has established relationships with an array of content providers that are willing to adapt their content for Connect To Learn projects. One such program is the Cowin Center Financial Literacy Program at Teachers College, Columbia University, which offers financial literacy teacher training for high school teachers using real-life scenarios.

The Cowin Center is open to collaborating with Connect To Learn to tailor content for different country contexts. Connect To Learn is also working to cultivate relationships with expert artisans and technical and vocational education and training (TVET) providers in Rwanda, Ghana, India and Myanmar.

Connect To Learn's monitoring and evaluation framework

Monitoring and evaluation is the backbone of Connect To Learn's work. Connect To Learn has been able to generate support to scale its early-grade literacy work as a result of robust evidence showing that the neuroscience-based method leads to improved learning outcomes among students. The mentorship and training support received by Connect To Learn's scholarship students has led to them being among the top performers in their classes in the schools where Connect To Learn works. Connect To Learn's ICT intervention and teacher training modules have been designed based on teacher feedback, classroom observation data and usage data collected via the Ericsson cloud.

Connect To Learn's various projects have used mobile data collection tools to collect data on key indicators. Connect To Learn has used the Open Data Kit (ODK) platform to collect data on forms developed on formhub.org, an open-source platform developed by engineers at the Sustainable Engineering Lab at the School of Engineering at Columbia University. Connect To Learn will continue collecting data in a similar fashion to enable real-time analysis and feedback to program interventions. This approach to data collection will be used to collect data on literacy and numeracy learning outcomes of learners, attendance, transition and completion rates of enrolled students, and higher education and employment outcomes of graduates. Connect To Learn partners from CSD and Ericsson are working to develop a data mapping tool that will show key indicators in learning and life outcomes from all sites where Connect To Learn works globally, and to make this tool available to advocates and decision makers to help inform policy and inspire investment in effective education strategies.

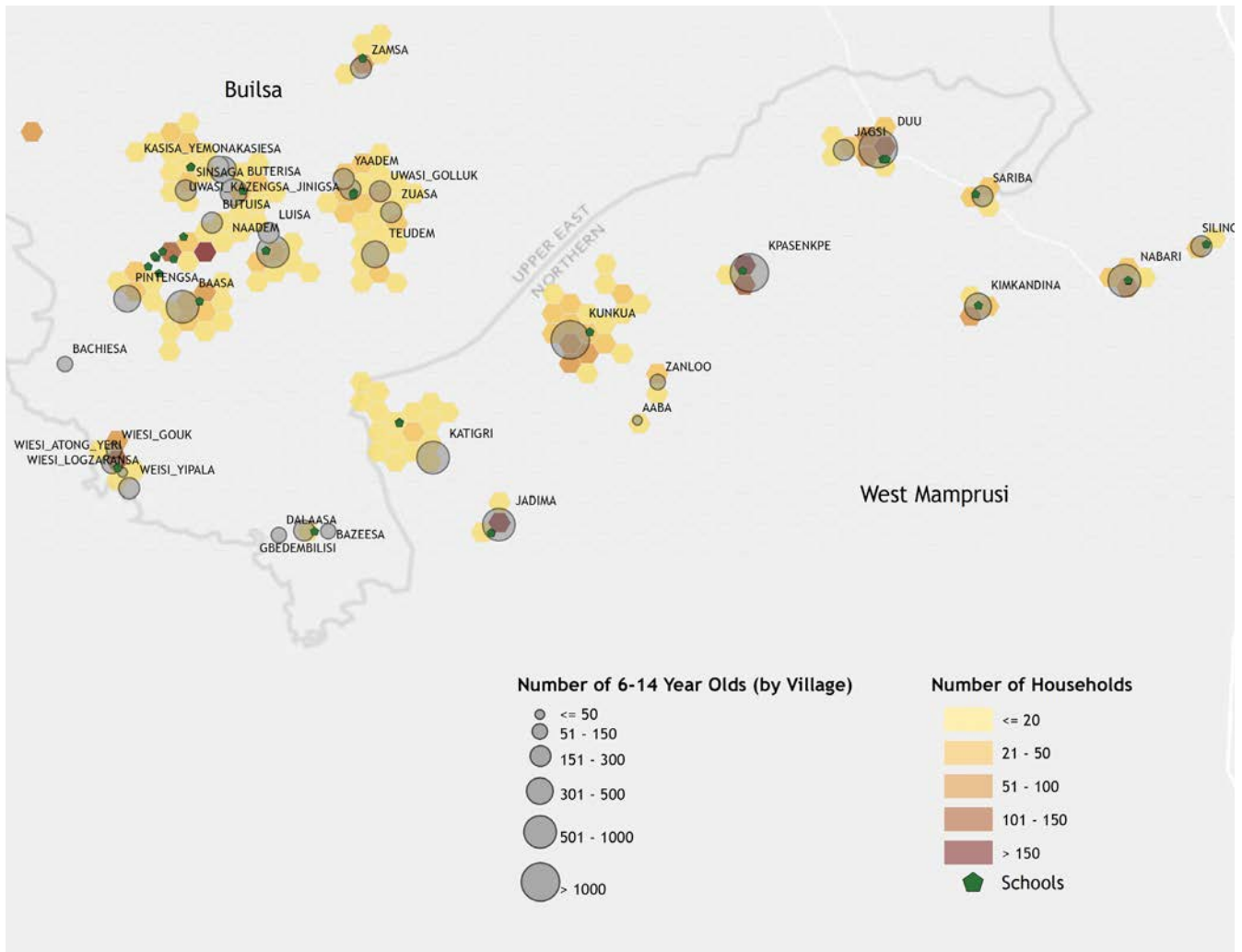
Below are some examples that outline how Connect To Learn approaches data collection to support its interventions:

Conducting Android-based facility mapping

Android phones have been used for mapping school facilities to collect data on infrastructure, service provision, student enrollment, and teachers. Each school facility survey on the phones was accompanied with the GPS location of the school, as well as a picture image of the school building. Android-based school facility assessments were conducted in the MVP sites on an annual basis. The annual survey included a large inventory of indicators including infrastructure heavy indicators, such as condition of the classrooms, availability of gender-separated toilets, availability of clean running water, meals provision etc. The main purpose of this tool was to easily record, aggregate, and disseminate the status of the schools. The ODK platform was used to collect data on the phones. Once the phone is connected to a Wi-Fi network, the survey was uploaded to Formhub, where it is available for download for downloading as a CSV or Excel file. The data is then summarized and can be displayed in the form of a report card. This technology-enabled data collection provided the status of the schools in real-time. This data was then discussed at the district education Government offices and village council meetings to ensure that the gaps at the schools were adequately addressed.

The mentorship and training support received by Connect To Learn's scholarship students has led to them being among the top performers in their classes.

Figure 5: Connect To Learn Project SADA, Ghana



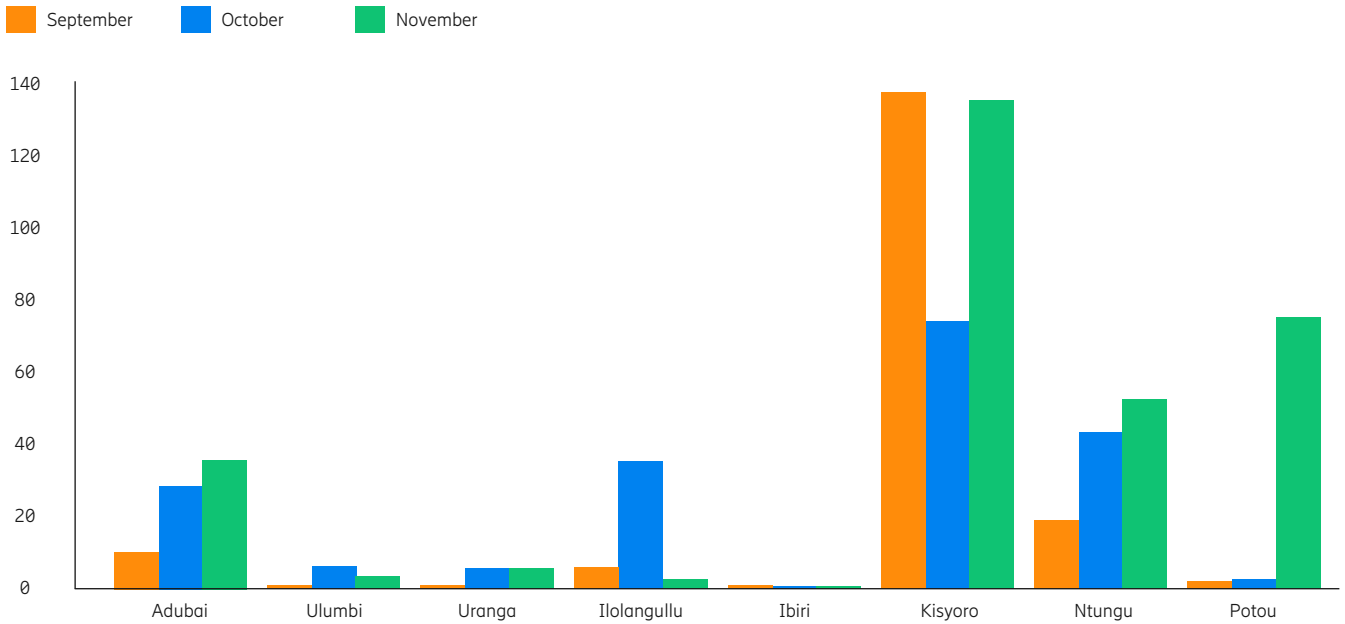
Spatial planning tools

Spatial planning tools have made education planning work much easier. Maps become visual aids which are easy to understand and have added utilities that aid in education planning. For instance, a simple GPS location of schools on a map shows the distribution of the schools in the area. It demonstrates whether the school coverage is adequate for the residing population. If the schools are clustered together, the children will have to walk a long way to reach the schools from the other parts of the cluster. This usually has a negative influence on school attendance and enrollment.

In SADA, Ghana, new standalone pre-schools have been constructed because the primary schools were too far for the young children to attend. Multiple factors influenced the decision of where to build new schools, including the distribution and density of the school-age population, the location of existing schools, and any geographical barriers to reaching the new schools (rivers, mountains, dangerous terrain etc.). Maps helped to present access to education in a more visually appealing way. It helped to combine all relevant information pieces required to assess whether the school going-population has an adequate number of schools in the cluster.

Number of 6-14 year olds in each village, in relation to the number of households and local schools in the area
Image source: MVP

Figure 6: ICT Usage



Monitoring ICT use

Are schools ICT ready? Connect To Learn requires each school participating to complete an ICT School Readiness Survey. The survey includes basic questions such as source of power, number of outlets in each class, days with regular electricity, connectivity at school (if any), existing computer lab at school, availability of a projector or a whiteboard at school, existing curriculum/syllabus on ICT, type of online resource used (if any) and the total number of student population and teachers at school. This then becomes the foundation for adapting technology to the learning needs of the school. The Connect To Learn package includes a baseline School Readiness Survey for any technology to be used in the school.

To monitor ICT-use indicators, Connect To Learn has been using data generated from Ericsson’s cloud solution to present monthly data to site teams. Data on usage, number of hours and application use are gathered on a monthly basis. This was further processed to send back simple graphs on the school’s total usage of ICT, as well as a site-by-site comparison. The snapshot of monthly use of ICT below is broken down by school. This data helped to ensure that the ICT installed in the schools was used, and if not, a quick turnaround on the reasons could be diagnosed.

Similar graphs on the type of software used for each school helped to understand the most common used software at schools.

Other regular indicators include the number of devices per student, number of teachers trained on ICT, number of devices at school, and quality of connectivity available.

Connect To Learn requires each school participating to complete an ICT School Readiness Survey. This then becomes the foundation for adapting technology to the learning needs of the school.

Case study: Voices from the field



Image source: CSD

Ruhiira, Uganda

"School data is collected monthly by CEWs in each of the 21 primary schools and two secondary schools with which the Millennium Villages Project in Ruhiiira works. CEWs use smartphones and tablets to input the data, including the number of students currently enrolled, pupil attendance, and teacher attendance. These phones and tablets are currently being used by CEWs to collect data. The tests concern literacy (in the local language and English) and mathematics. Ten students from Primary 3 class are selected at random and shown a story, and some math problems. Points are given based on student abilities (Zero points if they read nothing, one for a letter, two for a word, three for a paragraph, and four for a story).

CEWs then submit this information to the monitoring and evaluation team. They look over the data and submit it onto the servers. After they post the information, a quick analysis is conducted. Once the analysis is completed, it is sent back to the data management team in the MVP Ruhiiira (at the Mbarara office) and disseminated to sector coordinators.

For the education sector, the team leader reviews the analysis and calls a meeting with the education team for further discussion and synthesis. These meetings are held at least monthly (while school is in session). The team leader distributes a final report based on the CEWs and M&E's findings and shares it with district education officials. Sometimes the education team meets with district education officials to discuss the findings and hard copies of the reports are shared, but monthly meetings are not necessarily consistent. With input from all education sector staff, the data collected, analyzed, and disseminated then informs practices, according to an education facilitator with MVP.

I can conclude that data is shared with many relevant stakeholders, including those noted above (district education officials and the monitoring and evaluation team) as well as the schools' head teachers."

Source: Conversation with the MVP Education Coordinator in Ruhiiira.

Mbola, Tanzania

"Mbola has shared the previous report in a general education stakeholder meeting that was held on 24th September 2013 and involved the District Education Officer, Ward Education Coordinators, School Committees' chairpersons, Head teachers and all cluster CEWs. To improve the indicators, the site also launched MVP Mbola Education Cup where schools will be competing to win the title. During the meeting, the three best schools in terms of Teachers' and student's attendance, literacy and numeracy rates were awarded. The competitions will happen on a quarterly basis. Minutes of the meeting will be shared over the coming week".

Source: Conversation with the MVP Education Coordinator in Mbola.

Measuring teacher and student digital literacy

It is now widely recognized that ICT skills are prerequisites for the majority of job markets. To measure the ICT skills aligned to SDGs, the International Telecommunication Union (ITU) has defined indicators that measure "ICT Skills." The indicators include a set of 9 skills including copying or moving a file or folder, using copy and paste tools to duplicate or move information, sending emails with attachments, using basic arithmetic formulas, connecting and installing new devices, finding, downloading, installing and configuring software, creating electronic presentations with presentation software, transferring files between a computer and other devices and writing a computer program using a specialized programming language. These constitute the basics of ICT skills for SDGs. Digital literacy, as defined by the International Computer and Information Literacy Study (ICILS) is defined as "an individual's ability to use computers to investigate, create, and communicate in order to participate effectively at home, at school in the workplace and in society." Connect To Learn intends to operationalize these indicators in the context of learning a topic. For instance, learning about volcanoes could be taught using the technology with activities that involve the above given indicators as well. Therefore, Connect To Learn intends to improve digital literacy in the context of learning core curriculum content.

Connect To Learn has developed an adapted learning assessment on ICT skills by shortlisting and contextualizing from the Latin America computer literacy questionnaire by Dr. Julian Cristia or Inter-American Development Bank, and the Romanian computer literacy questionnaire by Professor Malamud from University of Chicago and Professor Pop-Eleches from Columbia University. For the selection process, the Connect To Learn team calculated the computer literacy indicators and used regressions to identify a subset of questions that can best predict the overall computer literacy, and then further shortlist them based on judgment of their appropriateness to the Connect To Learn schools. For example, given the current ICT progress revealed by the June-2012 Android survey, questions on email and printing are excluded. Finally, the team revised the questionnaire to let them reflect the characters of the Connect To Learn netbooks. For example, students' knowledge is tested on LibreOffice rather than on Microsoft Office. This test is specifically designed for Connect To Learn using the Ericsson technology. To date the tool has been used in several Millennium Village sites as well as in Myanmar to date.

Connect To Learn also measured progress through collection of teacher feedback through interviews and surveys, classroom observations, focus group discussions with the students, parents and spotlight interviews with the students.

Connect To Learn intends to improve digital literacy in the context of learning core curriculum content.



Image source: CSD

Monitoring teaching practice and learning outcomes

With the understanding that changes in teaching practice and learning outcomes tend to happen slowly, the Connect To Learn team from CSD has developed a framework that looks at changes in these areas over time. Data collection activities include structured classroom observations, surveys and interviews with teachers and school leaders, focus groups with learners and parents, and learning assessments. Classroom observations are a core element of this framework, allowing researchers from CSD to look at nuanced changes in teaching practices over time as teachers receive ICT and pedagogical training. Surveys, interviews and focus groups are designed to help the Connect To Learn team identify and understand key barriers and facilitators to improving uptake of ICT tools and interactive pedagogies by teachers.

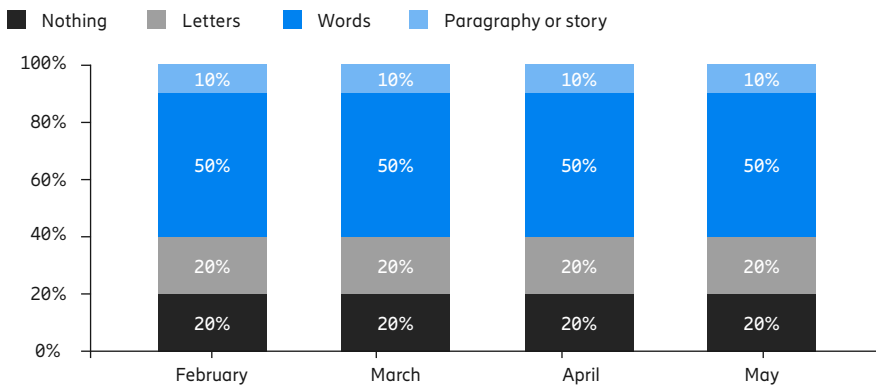
In Connect To Learn's early grade literacy projects, learning assessments designed according to the standards of widely used tools such as the EGRA, Uwezo and Aser tools are used to measure progress toward learning targets. As described in the Focus Area 1 section, students participating in Connect To Learn's pilot literacy program, as well as a control group, were tested at the start and end of the intervention using adapted versions of four EGRA subtests in Chichewa, including knowledge of letter names, knowledge of letter sounds, fluency and comprehension. The findings showed that, by the end of the pilot, the treatment group could read 13 more letter sounds per minute than the control group, and could identify 62 percent of letter sounds, while the control group could identify 36 percent.

While no internationally recognized tool yet exists for assessing literacy skills at the secondary level, the Connect To Learn team from CSD has piloted a tool adapted from EGRA for students

transitioning to the secondary level in Mbola, Tanzania. The passage length was determined based on a literature review of what a minimum word per minute rate is for students at Grade 7 level, with the text chosen from Tanzanian Grade 7 textbooks. The pilot literacy assessment conducted with Grade 7 (the final grade of primary school) students in Mbola showed that students struggle considerably with reading in English. Only 3 of the 24 students assessed were able to complete the short passage within the 60 seconds allotted, and of those 3, only 1 answered all the comprehension questions correctly. What was telling was that nearly all of these students had no trouble reading in Kiswahili, pointing to the problem being specifically with their English language skills, and not with their ability to read. Findings like these are what drive Connect To Learn's focus on improving acquisition of reading skills and helping teachers to facilitate bilingualism in English as quickly as possible in the early grades.

Case study: Example for use of the School Report Cards: Voices from the field, Mayange, Rwanda

Figure 7: School Report Card. literacy level of sampled students (English)



Example of the data collected from the School Report Cards: Voices from the field, Mayange, Rwanda

Image source: MVP

“Monthly data collection has been very useful to plan immediate interventions that can lead to better results. The Monthly Report Cards are shared with the Regional Education Sector Office. Normally the report cards are shared during education meetings at the sector level that brings together all education partners working within Mayange, NGOs both local and international, the local government from the zone, to the Sector level and head teachers from all schools in Mayange, and CEWs. This office comprises of International and Local NGOs, Head Masters of the schools in the region, local leaders, project teams and CEWs. This Sector Office is a part of the NGO Platform that is there in the region which includes other sectors such as health and sanitation as well. Some INGOs represented here are members of the Rwanda Education NGOs Coordination Platform (RENCNP). A few selected members of this platform also form the task force at the General Assembly at the national level. MVP Education Coordinator first shares the report cards with the Head Masters of the schools each month. He prints a copy for each of the Head Master and discusses the educational monthly trends. The same report card is then shared with the Sector Office where the Head Master is also present.

The Sector Office meets every month to discuss educational issues in the region. Before the meetings, which are held once a month and at times don't take place due to sector office being busy with other assignments, the report cards are shared with the head teachers during routine school visits. They are all excited and surprised with the report cards since most of them actually thought things were better than the results, this arouses more discussions and directs the meeting to identified weak points from the report cards.

In the meeting in July, the attendance issue was discussed. This indicator is included in the report card. Most of the members found it surprising that the student attendance was low for the month. After a lot of discussions, it was decided that the CEWs will raise this issue in their home visits and involve the parents and the community to improve student attendance. Therefore, the CEWs are now informing parents about the importance of sending the children to school regularly. Posters presenting the data in simplified form are also used at these Sector meetings. Future plans include color printing the school report cards and pinning-up at various spots in the community to raise awareness on educational issues. The team will

also be translating the posters into the local language (currently they are in English) to spread awareness among the community. The plan ahead is to have these report cards shared at the ministerial level through RENCP as we always do and have as many copies pinned to notice boards across Mayange as possible, that is at the school, zone, cell and sector offices and translated into the local language for all to understand.”

Source: Conversation with the MVP Education Coordinator in Mayange.

Looking ahead



Image source: MVP

For the past 5 years, well before the adoption of the SDGs, Connect To Learn has been laying the groundwork for addressing SDG 4's targets through concrete, data-driven solutions. Now as we embark on the SDG era, Connect To Learn plans to continue building upon its lessons learned to date and scale its impact. The challenges of the SDG era are complex and interconnected, and the SDGs present an ambitious roadmap to addressing the challenges the world faces. Technology is often presented as a panacea to these challenges, and while the potential of technology to play a significant role in addressing many of the world's challenges is great, it is critical that stakeholders implementing technology solutions are firmly rooted in research and experience of implementing organizations in developing country contexts so that solutions can be tailored appropriately and adequately resourced. Without such attention to design detail and localization,

technology interventions can easily waste a lot of time and money with little to show as a result. Connect To Learn will continue doing the work of demonstrating how education quality can be enhanced, and learning and life outcomes improved through integration of technology tools in diverse education settings. We are looking for like-minded partners to join us in this effort in order that by 2030, we can proudly say that the world we share is one where all women and men, girls and boys can reach their full potential. Going forward, the Connect To Learn package would be customized to the need demonstrated by the schools. This package could include teacher kits, tablets, projectors, printers and local content storage on the hardware side. On the software side, carefully curated educational teaching materials will be placed on software that is easily searchable by topic. The materials will be locally relevant and will have a global outlook. Supporting technologies include cloud,

where the complexity of technology can be removed from teachers who instead can focus on integrating technology into the classroom. Underpinning all of this is the broader availability of cost-effective mobile broadband solutions that enable great things to happen in classrooms. A clear need should be articulated by the national or regional governments. This will help to bring the different partners together.

On a broader scale, there are still many rural areas that are out of coverage or do not have 4G or even 3G coverage, and there is a need to forge public-private partnerships to resolve the last mile problem.

The Broadband Commission Working Group Report on Education 2017¹ suggests reducing the digital divide between countries and emphasizes key recommendations such as improving the digital literacy skills of workforce including the teachers, using the available technology in innovative ways and promoting Open Educational Resources (OERs), among other key recommendations. Schools play an important role in using technology to ensure that the future workforce have the skills needed to be gainfully employed. Therefore, national government bodies such as the Ministry of Education and the ICT Ministry should collaborate to find ways to bring technology to educational institutions. The national policy on Mobile Broadband should highlight the importance of connecting schools. Improving digital literacy at schools will have a ripple effect in the community and the local businesses.

Digitalization is also expected to change the whole context in which businesses and business processes are organized. This is troubling, as access to quality education and relevant digital skills continues to be a major issue globally. Those countries that react first could have opportunities to 'leapfrog' some stages of economic development. Digital skills are crucial for jobs in a world that is increasingly connected and digitized. There is a continuum of digital skills ranging from optional to critical, and from deep technical knowledge to complementary soft skills, such as the ability to communicate effectively in online and offline mediums. UNESCO describes digital skills as a continuum of skills to use digital devices; communication applications; and networks to access and manage information; create and share digital content; communicate and collaborate; and solve problems for effective and creative self-fulfillment in life, learning, work, and social activities at large.²

Entry-level digital skills, meaning basic functional skills required to make rudimentary use of digital devices and online applications, are widely considered to be a critical component of a new set of literacy skills in the digital era, alongside traditional reading, writing, and numeracy skills. At the advanced end of the digital skills continuum are the higher-level abilities that allow users to make use of digital technologies in empowering and transformative ways, including abilities that form the basis of specialist ICT occupations and professions. Major digital transformations such as Artificial Intelligence, machine learning, the Internet of Things (IoT), and big data analytics, continue to heighten the level of digital skills, and skills development required for the 21st century digital economy. To thrive in the connected economy and society, digital skills are not sufficient; they must function in concert with other complementary cognitive and non-cognitive skills, such as strong literacy and numeracy skills as well as a host of intrapersonal and interpersonal skills, including critical and innovative thinking, complex problem solving, an ability to collaborate, and socio-emotional skills. (UNESCO often refers to these diverse yet interconnected skills as global citizenship skills).

Embedded within the six key strategies outlined earlier is Connect To Learn's strong focus on digital skills development. Initiatives range from basic ICT skill development for teachers, as part of in-service professional development programs, to focused learning modules for school children focused on developing basic programming and coding skills. For example, Ericsson has deployed a very successful Digital Lab program to children aged 11 to 14 in Sweden that teaches basic programming concepts, robotics and game development. Connect To Learn is now expanding this program to more countries as the need grows for more programs that go beyond teaching the most basic of ICT fundamentals to school children.

Digital skills are crucial for jobs in a world that is increasingly connected and digitized.

¹ For the full report, please visit: <http://broadbandcommission.org/Documents/publications/WG-Education-Report2017.pdf>

² UNESCO, Mobile Learning Week: Skills for a Connected World (2018)

Sustainability and scalability

The key intervention areas outlined above all make use of technology in ways that will facilitate scalability of the solutions and resources developed as part of Connect To Learn's programs. To help ensure ongoing success and sustainability of Connect To Learn's ICT investments in schools, Ericsson is also engaging their internal professional development experts, in training their staff globally to be Connect To Learn volunteers, equipped to go into the field and support Connect To Learn projects with technical expertise and training. These trained volunteers will help Connect To Learn sites receive more immediate assistance when technical challenges arise.

Although electricity shortages and internet connectivity issues are still a lived reality in rural sub-Saharan Africa, the technology used by the MVP site has tried to adapt to this to make learning possible. New technologies powered by solar energy provide a great promise. Mobile devices that could move from classroom to classroom will help save valuable space at school. Working with existing site-based technologies like smartphones may provide the teacher support needed. Connecting urban to rural teachers using videos will help share educational materials beyond geographical boundaries. Easily downloadable videos could be shared within the teachers' network. This will help to avoid huge costs for in-service teacher training. Education could go beyond institutions and in the community through cyber-cafes. Connect To Learn scholars could gain experience by engaging in income-generating activities such as typing letters/reports, manage the cyber-café and earn funds to continue their education. Community cyber-café could be places of learning for second chance students and drop-outs. These cyber-café could be used as education centers during the day and open to the public in the evenings. Connect To Learn will actively look for partners in the solar energy sector to collaborate in setting up community-based education centers benefitting the whole community while helping develop skills and sustain basic income for education for learners.

Using television could be another way of reaching the hard-to-reach population such as adults and the elderly. Developing content for adults through television broadcast will help to realize the "life-long learning" SDG goal.

Existing and new partnerships with Colleges and Ministries of Education will also help facilitate scale-up of Connect To Learn's demonstrated strategies in project countries. Data on student achievement and teacher practice for early grades will remain instrumental in shaping the remediation. Similar measures will be adapted for upper primary and secondary levels to evaluate effectiveness of Connect To Learn's gender empowerment and technology programs. Collection of these metrics will help contribute to more nuanced data within countries that often lack detailed data from the hardest to reach regions within them. Local districts will be closely engaged in Connect To Learn's data collection activities in order to build capacity for continuation of monitoring efforts beyond the project period.

The various datasets generated by the project will inform local authorities as well as the international community. This would be part of the "data revolution" envisaged for the SDG era. Results of each round will be disseminated in various forums at the school, village, local and national levels. Community members and government education officials' participation in the data collection activities will have a ripple effect on other teachers and districts to adopt the same methodology.

The success of an intervention lies in its scale. Lessons from the MVPs will be scaled-up in Karamoja region of Uganda, Kaduna State in Nigeria and the northern Ghana SADA region. The governments have shown deep interest in expanding Connect To Learn to meet the SDGs. CSD will continue to work in the capacity of providing research-based evidence and bring cutting-edge research into operation. CSD will also play a vital role in teacher professional development as in the past. Ericsson will provide the technical knowledge on the technology side. This will involve leveraging other technology partners to purchase/donate devices and ICT equipment. It will also help in bringing connectivity to the sites with the help of other partners. MP will continue to remain a vital partner on the ground to carry out the actual implementation along with the national and local Governments in Sub-Saharan Africa.

About the authors



Tara Stafford Ocansey

Tara Stafford Ocansey is an education and creative media professional with extensive experience in program management, and working in diverse education settings. In her three years with Connect To Learn, Tara has managed a year-long study in Kenya and Uganda, identifying best practices to integrating technology tools in rural, resource-poor classrooms; coordinated Connect To Learn's scholarship programs in ten countries in sub-Saharan Africa; developed teacher training modules in the integration of technology in teaching practice, and; helped launch Connect To Learn's program expansion in Myanmar. Prior to joining Connect To Learn, Tara was a Research Fellow with the Council of American Overseas Research Centers, researching how evaluation efforts measure social change impacts of non-formal adult literacy programs in Senegal, Ghana and Bangladesh. Tara has her MA in Comparative and International Education from Teachers College, Columbia University and her BA in Cinema-Television from the University of Southern California.



Radhika Iyengar

Radhika Iyengar has a Ph.D. in Economics of Education from Teachers College at Columbia University in 2011. Teachers College awarded her distinction on her dissertation on "Social Capital as a Determinant of Schooling in Rural India: A Mixed Methods Study." As the Education Director for the Millennium Villages Project (MVP) for 10 countries in Africa and the Scale-up Operations at the Earth Institute Columbia University, Dr. Iyengar oversees multi-country research projects. She has been able to form multiple in-country partnerships to facilitate teacher professional development. Dr. Iyengar has also led efforts to assess the use of technology for large scale educational planning at the local level in Nigeria for Earth Institute's Nigeria Scale-up Initiative a joint project between the Earth Institute and the Office of Special Assistant to the President of Nigeria on MDGs (OSSAP). She also holds an Adjunct Assistant Faculty position at the Teachers College, where she taught a graduate level course on Evaluation Research Methods and Data Analysis for Developing Countries. She has been successful in bringing a more scientific rigor to the multiple projects she leads by merging her developing country experience with her technical training at Teachers College, and her practical experience is of much interest to students and faculty alike. Dr. Iyengar is the Principal Investigator on multiple research studies at the Earth Institute. At present, she is the lead researcher for a study on assessing the learning levels of children in 10 schools in Ghana. Her research interests in conducting evaluation of educational programs and international educational development is in line with her role and responsibilities at the Earth Institute.



Haein Shin

Haein Shin is an Education Technical Adviser at the Earth Institute, Columbia University, with over seven years of experience including international fieldwork and providing research, program implementation and management for education projects in low-income areas across 10 countries in West and East Africa, India, Myanmar and MENA region. She conducts M&E data collection and analysis for education projects on conflict resolution and information and communications technology (ICT) and manages a scholarship program serving 31 schools. She contributed to the fruition of youth and community education programs in Morocco with the United States Peace Corps and developed educational materials to improve learning outcomes, literacy, youth development and teacher training practices for the Millennium Villages Project, Mwenge University, Connect To Learn and Hindupat Institute of Teacher Training. She has supported the review of the Nigerian government's grant proposal for over 100 local government areas for education and has planned and managed implementation of health education program for a women's university in the Middle East. Her professional interests include education in international development, pedagogical methods and child development. She received her M.A. in International Educational Development from Teachers College, Columbia University and B.A. in International Relations from The College of William and Mary.

**Paul Landers**

Paul Landers is Head of Partnerships at Ericsson's Connect To Learn program.

With experience in both the public and private sector, Mr. Landers has studied the potential and implementation of ICT in education for over two decades. He started his career as a public-school teacher in Ireland focusing specifically on ICT use in primary schools and the development of teacher training programs. Since joining Ericsson in 1998, he has been deeply involved in the creation of corporate eLearning programs both within Ericsson and as a consultant for supporting business partners around the world.

Mr. Landers earned a B Ed from St Patrick's College Dublin and an MSc from Dublin City University where he researched the impact of eLearning in corporate environments. Research into mobile learning applications has also been a key area of inquiry. Partnering with different European universities, he has led several EU programs aimed at exploring the intersection of technology and education. He has been a regular speaker at global conferences on ICT, education and sustainable development. In 2014 Paul initiated Connect To Learn's largest project to date in Myanmar which assembled a public-private partnership designed to improve access, literacy and life skills for 21,000 students with a specific emphasis on marginalized girls.

**Zohra Yermeche**

Zohra Yermeche is Program Director for Connect To Learn at Ericsson.

Dr. Yermeche oversees the development and deployment of Ericsson's ICT solutions in schools across the world. She has worked at the intersection of ICT and education in various projects around the globe.

Most recently she has successfully led the Connect To Learn project implementation and deployment in Myanmar coordinating the effort of a large coalition of public and private partners. Dr. Yermeche received her Ph.D. in Applied Signal Processing from the Blekinge Institute of Technology (Sweden). Her teaching experience at graduate and postgraduate level spans across different universities, from the Blekinge Institute of Technology in Sweden to Fachhochschule Darmstadt in Germany and National University of Rwanda as a visiting teacher. Her professional experience includes working as a senior researcher in Multimedia Technologies at Ericsson Research.

Ericsson enables communications service providers to capture the full value of connectivity. The company's portfolio spans Networks, Digital Services, Managed Services, and Emerging Business and is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's investments in innovation have delivered the benefits of telephony and mobile broadband to billions of people around the world. The Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

www.ericsson.com