

Online Learning Models - How to include youth in low bandwidth areas

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Executive summary

This Brief is part of the [Solutions for Youth Employment \(S4YE\)](#) Knowledge Brief series focusing on the design and implementation of youth employment programs.

The outbreak of Covid-19 has accelerated efforts by practitioners to rapidly move learning, skills building and mentoring online. Practitioners need to address how they will reach the youth in low bandwidth areas. If this is not confronted, the youth in rural, remote and disconnected areas will be further marginalized.

In this Knowledge Brief, we address the need of tackling low bandwidth challenges for youth learning opportunities, job creation and inclusion. We highlight how some programs are developing solutions to reach youth in low bandwidth areas. We focus on 5 different strategies that youth employment programs can employ to integrate the youth in low bandwidth areas by adapting their learning content to an online delivery model. These strategies include: 1. Download offline; 2. Use Raspberry Pi; 3. Utilize bite-sized courses; 4. Employ mobile vans; and 5. Leverage ad hoc networks. Learning from successful initiatives and taking our strategies as a first guideline will help practitioners to adapt their approach and ensure that the youth can reach their full potential –even in low bandwidth areas.

1. The Impact of Bandwidth on the Economy, Job Creation and Upskilling

Why it is essential to address low bandwidth issues:

Bandwidth speed is a powerful technology that has encouraged the rapid expansion of any Information Technology (IT) -related services such as cloud computing and mobile apps. Similarly, it functions as a catalyst for the seamless distribution of content around the globe that can be leveraged for job creation and upskilling purposes.

Especially in the current Covid-19 environment youth programs have adapted their training and support services to an online delivery model. However, remote areas with low bandwidth speed are at risk of being left behind, when they cannot include the youth with online employment services such as job training, which could further marginalize them. This provides the impetus to address this pressing issue, so that practitioners can provide better and more up-to-date training and mentoring services to youth

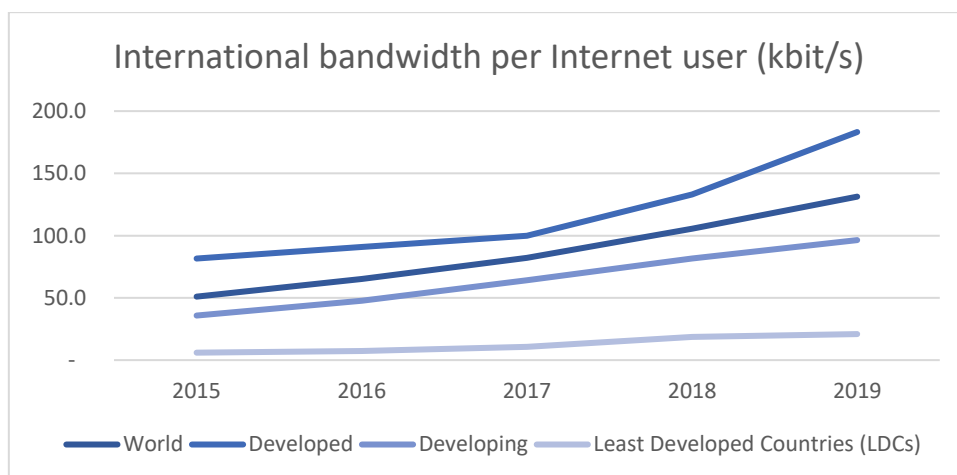
Adequate bandwidth speed enables synchronous and asynchronous distance learning and communication as well as collaboration regardless of the geographical location. In the long run, this is associated with wider socio-economic benefits for local communities in the form of higher equality and inclusion in addition to increases in household income.¹ Unsurprisingly, it can exert significant

¹ European Commission (2013), “The Socio-Economic Impact of Bandwidth” <https://ec.europa.eu/digital-single-market/en/news/study-socio-economic-impact-bandwidth-smart-20100033>

positive effects on a country’s economy. For instance, a 10 percent increase in fixed broadband penetration would increase GDP by 1.38% in developing economies.² For OECD countries the implied GDP effect from broadband is estimated to be 0.30% per year.³ Directly linked to this is the positive impact of broadband on youth employment opportunities in rural communities. Broadband boosts employment across industries with each broadband-enabled job creating between 2.5 - 4.0 additional jobs.⁴ In Malaysia alone, it is estimated that a broadband penetration rate of 50 percent could create 329,000 jobs by 2022.⁵

While the world has experienced a steady increase in bandwidth speed over the last few years, widespread differences between developed and developing economies still exist. Bandwidth per user remains below 25 kbit/s on average in least developed economies, which limits the possibilities to leverage the benefits of online services⁶. Especially rural areas are still lagging, both in terms of coverage and bandwidth speed.

Figure 1. International bandwidth per Internet user. Data based on International Telecommunications Union Indicators⁷



² World Bank (2016), “Digital Dividends, World Development Report - Exploring the Relationship Between Broadband and Economic Growth” <http://pubdocs.worldbank.org/en/391452529895999/WDR16-BP-Exploring-the-Relationship-between-Broadband-and-Economic-Growth-Minges.pdf>

³ Koutroumpis (2018), “The Economic Impact of Broadband: Evidence from OECD Countries” https://www.ofcom.org.uk/_data/assets/pdf_file/0025/113299/economic-broadband-oecd-countries.pdf

⁴ World Bank (2012), “Broadband Strategies Handbook”, <http://documents1.worldbank.org/curated/en/841491468326182239/pdf/676200PUB0EPI0067882B09780821389454.pdf>

⁵ Ibid.

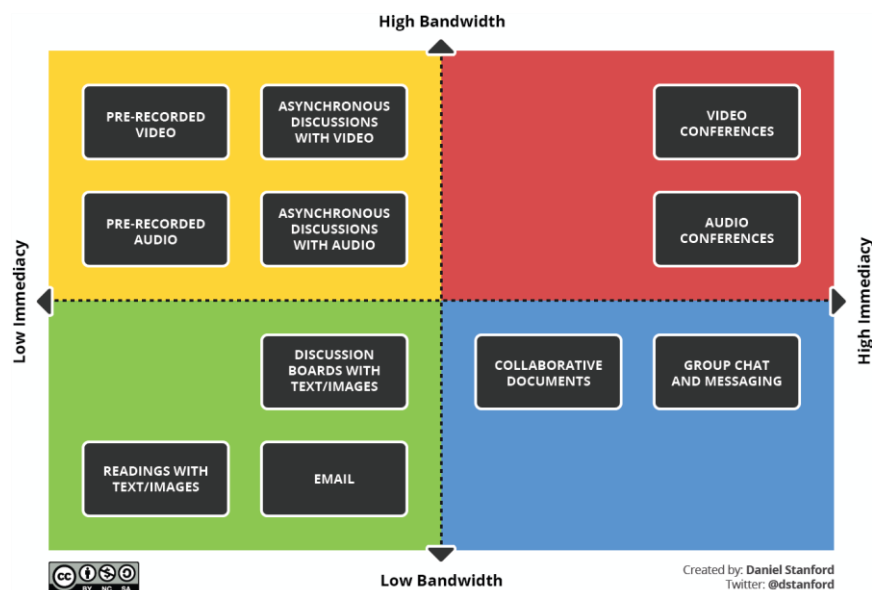
⁶ Chen, Y., Farley, T., & Ye, N. (2004). QoS requirements of network applications on the Internet. Information Knowledge Systems Management, 4(1), 55-76.

⁷ International Telecommunications Union (ITU) (2020), “ICT Indicator Aggregates” <https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx>

2. How youth employment programs are addressing bandwidth challenges?

With Covid-19 numerous youth employment programs pivoted to provide several services virtually like training and job matching. There are a variety of different approaches organizations can take to provide online learning, training, mentoring and soft skills building even in low bandwidth environments. However, the right solution will differ according to the nature of immediacy that a particular educational program requires. The Bandwidth – Immediacy matrix⁸ allows us to map the different options in a 2x2 matrix.


Figure 2. The Bandwidth - Immediacy Matrix



Here, bandwidth informs the way in which the instructor and student can interact with one another, distribute and consume content, while immediacy refers to how fast we expect students to respond when interacting with teachers and other students. In this section, we discuss the types of interventions that practitioners can use in low bandwidth environments.

⁸ Stanford, D. (2020), "Videoconferencing Alternatives: How Low-Bandwidth Teaching Will Save Us All" <https://www.iddblog.org/videoconferencing-alternatives-how-low-bandwidth-teaching-will-save-us-all/>

Table 1. High level overview of potential technologies to address low bandwidth challenges

Bandwidth level needed	Technology Category	Benefits
<p style="text-align: center;">Low</p>  <p style="text-align: center;">Medium/high</p>	Radio Broadcasting	<ul style="list-style-type: none"> • Relatively easy to reach a wide audience. • No bandwidth required.
	SMS	<ul style="list-style-type: none"> • Allows instructors to provide bite-sized prework materials. • Enables organizations to disseminate content to anyone with mobile phone access.
	Multi-media compression	<ul style="list-style-type: none"> • Reduces file size to create ‘bite-sized’ content that can be uploaded/ downloaded even in environments with low bandwidth.
	Pre-recorded video/audio	<ul style="list-style-type: none"> • Download to a hard drive at a single point in time (requires sufficient bandwidth at a local point). • Can be consumed at any point in time. Allows for a flexible learning experience.
	Mobile apps / Websites	<ul style="list-style-type: none"> • Creates an engaging, real-time learning experience. • Provides a plethora of options to design the course materials. Relatively easy to gather feedback on course design via polls and surveys within the app. • Option to develop an intuitive or quiz-like user interface that sparks learners’ interest in course materials. • Ability to optimize content for feature phones.

To create an engaging experience, most successful organizations will try to leverage different types of media where possible. This creates a holistic content design that emphasizes and recognizes the local particularities of learners.

3. Some Solutions being used by Practitioners – Case Studies

While low bandwidth speed can pose severe limitation to the content design, some organizations have adopted solutions that specifically address the bandwidth challenge.

Table 3. Case Studies- Online training in low bandwidth areas

Project Name	Countries of operation ⁹	Key areas addressed by the project	Approach / Design innovation adopted
EVERY1 MOBILE	<ul style="list-style-type: none"> Kenya Nigeria + 15 countries in Africa and Asia 	<ul style="list-style-type: none"> Soft Skills Building Mentoring & Motivating 	<ul style="list-style-type: none"> Mobile-accessible websites and apps that are accessible on any internet-enabled feature phone.
Funzi	<ul style="list-style-type: none"> Malawi South Africa Uganda Nigeria 8 mio. Global learners 	<ul style="list-style-type: none"> Learning Skills development 	<ul style="list-style-type: none"> Data light courses focusing on upskilling and training.
e-Granary Digital Library	<ul style="list-style-type: none"> India Bangladesh Haiti 	<ul style="list-style-type: none"> Learning 	<ul style="list-style-type: none"> Educational resources from more than 2,000 web sites and 60,000 books than can be downloaded offline.
Raspberry Pi Foundation	<ul style="list-style-type: none"> Global reach 	<ul style="list-style-type: none"> Learning Skills development 	<ul style="list-style-type: none"> Runs successful coding education programs. Sells affordable go-to microcomputers, helping students learn programming.
Microsoft Community Training Platform	<ul style="list-style-type: none"> Nigeria Kosovo India Timor-Leste Ukraine 	<ul style="list-style-type: none"> Learning Skills development Soft skills building 	<ul style="list-style-type: none"> Mobile first and mobile only app.
Mobile Training Center – S2S	<ul style="list-style-type: none"> Bangladesh 	<ul style="list-style-type: none"> Mentoring Learning 	<ul style="list-style-type: none"> Bus 3G/4G equipped with portable Router Access Points. Providing digital skills training and mentoring to marginalized youth.
DakNet	<ul style="list-style-type: none"> India Cambodia 	<ul style="list-style-type: none"> Digital infrastructure that the 	<ul style="list-style-type: none"> Ad hoc network that leverages wireless technology to provide

⁹ Non-exhaustive list.

		youth employment services, and training content can use	asynchronous digital connectivity at a low cost.
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Five strategies being used by youth employment programs in low bandwidth areas

1. Offline downloading - Offering learning resources and education

Education and training are key components of solutions for youth employment. They help the youth break the inter-generational barrier of poverty. However, providing online learning resources in remote and low bandwidth areas is challenging. Two innovations show this can be addressed. Firstly, offering learners to download content offline allows them to consume content even when they don't have internet access. The [e-Granary Digital Library](#) demonstrates that is scalable and cost-efficient.

Box 1. Downloading content offline

e-Granary Digital Library

This World Bank initiative provides those who lack adequate bandwidth an offline collection of more than 30 million educational resources from approximately 2,000 websites and 60,000 books. Contents can easily be downloaded to a local hard drive. This allows learners to consume content even in the most remote areas that lack internet access. Today, there are eGranary installations in more than 450 schools, clinics and universities in Africa, India, Bangladesh, and Haiti.

2. Use Raspberry Pi – Low Cost Hardware

Making use of low-cost hardware is key in providing learners with devices that help them build their digital skills and connect with others. Raspberry Pi runs on Linux, a free operating system from an SD card and it is powered by a USB phone charger. All the learners need is a mouse, a keyboard and a TV / monitor. The [Raspberry Pi Foundation](#) addresses this specific issue.

Box 2. Providing cost-efficient devices and building digital skills

Raspberry Pi Foundation

The Raspberry Pi Foundation helps the youth learn the necessary digital skills such as computing through interactive learning resources, volunteer-led clubs, competitions and partnership programs. Its go-to microcomputers sell at a price between \$30- \$70 and help students of all ages to learn the

fundamentals of programming through practical projects. To this day, over 30 million Raspberry Pi computers have been sold with more than 10,000 coding clubs around the world reaching 150,000+ young people every week.

3. Bite-sized learning – Increasing skills development and job prospects

Building the right skillset is vital for youth to enter the job market or explore entrepreneurship opportunities. Entrepreneurial skills that allow youth to design their own business ideas, work as subcontractors in the gig economy or open shops themselves can help increase opportunities for youth, especially in contexts where there are limited formal employment opportunities. An innovation in low bandwidth environments that can help with training in any regard is **bite-sized learning** that compresses lessons into smaller units that can be completed in less time and require less data.

Box 3. Bite-sized learning focusing on soft skills

*Funzi*¹⁰

Funzi¹¹ has a low-bandwidth offering available on funzi.mobi for any internet-connected mobile device, allowing learners to study anytime. Its course design is built around bite-sized, broken-down units that allows users to self-pace their learning. Its courses are helpful in low bandwidth areas as they function on any mobile browser and even work on slow networks and feature phones. Funzi's content runs smoothly even on 2G. This means that users have a low barrier-of-entry when it comes to upfront investment, costs and technology. All they need is one device they own or have access to. But also on a more regional level Funzi counters the lack of access to quality learning. Its gamified learning approach keeps the audience engaged. Course completion rates, which stand above 95%, are representative of this. Throughout its courses Funzi has a 50/50 distribution of male and female learners. The mission statement of Funzi's content is to develop a learner's soft skills and intrinsic motivation to perceive learning as a lifelong journey. Amongst these are upskilling projects, livelihood projects such as the Founder 101 course, which promotes inclusive entrepreneurship or CV training, that helps the youth in finding employment. Also digital skills find their way into Funzi's curriculum. For instance, its Promise Hub brings the tools for the digital age for youth in Uganda.

Being able to finance a low bandwidth offering can be a significant constraint for some organizations. Thus, providing attractive financing options for practitioners is key.

Box 4. How to keep costs down?

Microsoft Communities Platform

Microsoft's community training is an Azure powered learning app developed for organizations to run community learning programs at affordable prices with easy-to-manage technology. Customers do

¹⁰ Funzi (2019), "The Future of Learning and Employability is in Your Hands", <https://static1.squarespace.com/static/5fe99b1c75c773734d257bbe/t/603553a43f063e52dbea329b/1614107586303/Funzi+White+Paper+20210219.pdf>

¹¹ Funzi is a mobile learning company and platform for education with more than 8 million global learners.

not have to pay a licensing fee; they only pay for platform hosting. Nonprofit organizations are eligible for a \$3500 annual Azure credit that they can use for their Community Training consumption. The community platform is specifically designed and optimized for mobile device audiences. Its learners can take content offline, which offers flexible learning.

However, only focusing on hard skills is not enough anymore. Employers now increasingly value soft skills as they hire new recruits. Especially sought-after skills include ability to work in teams and communication skills. Yet, building soft skills is much more difficult in areas that cannot leverage the power of video conferencing that mimics face-to-face interaction. The case study of [EVERY1MOBILE](#) shows that it is possible to implement and run courses that help build soft skills like teamwork, communication skills and motivate behavioral change.

Box 5. Driving behavior change in low bandwidth settings

EVERY1MOBILE¹²

EVERY1MOBILE (E1M) is a social enterprise that develops digital solutions for interactive learning through e-learning journeys, skills training and community interaction. Importantly, their digital platform is optimized for mobile phones in low resource settings and accessible on any feature phone. E1M's geographic track record stretches across more than 15 African and Asian countries. Its courses can be specifically customized to people with low literacy and low digital literacy. EVERY1MOBILE's course content includes financial/digital literacy and gender equality. One of E1M's focus areas lies in creating behavior change programs. For instance, its app helps people to commit positive behaviors like handwashing with soap or saving money.

E1M's approach:

- Course design is characterized by a hyper **localized approach**. Using teams on the ground that can provide the appropriate language and considering contextual factors are two key success factors of E1M. Its course design allows to tackle the next steps: attitudes and confidence by building digital tools for online communities and motivation.
- Course optimization for low bandwidth areas: An entire learning journey only has a **total content size of 5 -10MB** and its bite sized course design approach allows learners to complete courses within 10-15 minutes.
- E1M engages in a constant iterative process, that allows E1M to have a go-to-market prototype ready within the first two months.

Some programs that E1M initiated in low bandwidth areas:

1. **Purple**, a program that ran in Nigeria, was conceptualized to deliver behaviour change messages via traditional and digital channels. As a result, a total of 107 Million people were reached with key messages through digital channels, which helped the youth work on their communication, decision making and leadership skills. Specific emphasis during the Purple academy's six chapter course was on changing gender norms, violence and women in leadership.
2. **U Afya, an E1M led program that ran in Kenya**, provides an online community to over 6,300 mums in Nairobi as well as online discussion forums where women share, learn and connect to build

¹² Every1Mobile(2020), "Using mobile technology to drive real-world behaviour change and combat COVID-19", <https://www.every1mobile.com/rapidly-responding-to-covid-19-using-mobile-technology/>

their confidence. For instance, rather than passively absorbing content on COVID-19, online forums encourage mothers to actively interact with each other. In order to support new behaviours, E1M used motivational tools like pledges, self-reported action tracking or challenges such as the 10-Day Handwashing Challenge, encouraging mothers to establish and maintain regular handwashing behaviour.

4. Employing Mobile Vans

Especially in remote areas, the lack of face-to-face interaction can lead to an absence of mentoring or motivation if course content is not engaging enough. This could lead to lower completion rates or higher drop-out rates all together. Mentoring is usually done through physical face to face interaction with mentors and instructors. A mobile training center that can travel and deliver these services to remote areas is helping to provide the youth with employment-focused services.

Box 6. Mobile Training Center – Save the Children’s Skills to Succeed (S2S) Program¹³

[Save the Children’s Skills to Succeed \(S2S\)](#) program provides the youth with a range of employment-focused services including employability, entrepreneurship and vocational training, on-the-job training, career counselling, mentoring and business start-up services.

The S2S program specifically points to the employment opportunities and the future potential in the Information, Communication and Technology (ICT) industry. Oftentimes there is a mismatch between unmotivated college graduates who leave lower-tier ICT jobs quickly and employers, who continue to require high school degrees. For instance, in Bangladesh the S2S program helped 6,810 youth to receive vocational training in ICT, so that they can obtain decent work in Bangladesh’s thriving ICT and Business Process Outsourcing value chain from which marginalized youth have traditionally been excluded.

The S2S program’s Mobile Training Center (MTC) is an innovative approach for helping the most marginalised youth in Bangladesh to gain the digital skills required. The MTC is set up in a large bus that travels through Chattogram to provide skills training and mentoring to girls and boys. Equipped with computers and internet access through 3G/4G portable Router Access Points, the MTC can overcome challenges of low bandwidth by providing their services at the doorstep of the most marginalised youth. This also helps break the participation barrier of costly and time intensive traveling to training centers. The course design allows learners to complete courses 1 ½ months if they visit the MTC daily. Despite Covid-19, S2S successfully put safety measures in place that allowed the implementation of the project.

5. Leverage ad hoc digital networks -

Several regions and remote areas in Africa continue to remain digitally disconnected. This prevents them from availing of digital online training and skill development programs. Ad hoc networks could provide a short-term solution in such cases.

¹³ Save The Children (2021) “Mobile Training Center: Closing the digital divide for the marginalized youth”

Box 7. Cost-efficient and scalable ad hoc networks

DakNet¹⁴

DakNet is an ad hoc network that leverages wireless technology to provide asynchronous digital connectivity at a low cost. The DakNet wireless network builds on the existing telecommunication infrastructure to disseminate digital connectivity to outlying villages that lack a digital communication infrastructure. DakNet functions by transmitting data over short point-to-point links between kiosks and portable storage devices, called mobile access points (MAPs). This is considerably cheaper than relaying data over a long distance. Then, low-cost Wi-Fi radio transceivers automatically transfer the data from the MAP at high bandwidth for each point-to-point connection.

This operation thus has two steps: Firstly, as a MAP-equipped vehicle comes into range with a Wifi-enabled kiosk, it automatically uploads and downloads all data. Secondly, when the MAP-equipped vehicle arrives in the range of an Internet access point, it automatically synchronizes the data from the kiosk. In this case a single vehicle passing by a small village once per day is already sufficient to provide information service. DakNet is also highly scalable, as a village grows it can utilize the same hardware and software to enjoy real time information access. Only fixed wireless antennas and towers would be needed in this case.

How to finance it? A capital investment of \$15 million could equip each of India's 50,000 rural buses with a \$300 MAP. This would provide mobile ad hoc connectivity to most of the 750 million people in rural India. Already now, DakNet has been successfully deployed in remote areas of India and Cambodia at a cost two orders of magnitude less than that of traditional landline solutions.

3. Conclusion

Low bandwidth speed remains a pressing issue that challenges youth employment organizations to effectively use online and blended training models. COVID has highlighted the urgency with which governments and development organizations should focus on providing access to broadband to all areas to ensure people and households are resilient and can continue to access education, training, run businesses, receive payments, buy daily necessities and access information online, even in remote areas. However in the short to medium term, it is critical for youth employment organizations to use agile innovative solutions to ensure that people in remote areas, who are often already poor and disadvantaged, aren't further marginalized, as the world of work and learning increasingly adopts online delivery models.

¹⁴ DakNet (2004), "Rethinking Connectivity in Developing Nations", <https://www.yumpu.com/en/document/view/31649506/daknet-rethinking-connectivity-in-developing-nations-first-mile->

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S4YE is a multi-stakeholder coalition that aims to provide leadership and resources for catalytic action to increase the number of young people engaged in productive work. It is a global program housed in the Jobs Group of the Social Protection and Jobs Global Practice of the World Bank Group. It consists of a network of over 35 private companies (Private Sector Advisory Council), a network of 44 high-potential and innovative youth employment projects (Impact Portfolio), a group of 17 talented and enterprising global youth (Youth Advisory Group) that provide youth voice on the design of youth employment programs of S4YE and the World Bank and has a network of 150 World Bank youth employment projects in 69 countries.

This knowledge brief does not necessarily reflect the views of the World Bank or each S4YE partner. For additional resources for youth employment, please visit <https://www.s4ye.org/s4ye-publications>