



United Nations  
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# Guidance Note 7

## Ensuring resilient connectivity

From the Report: Education for the  
most marginalised post-COVID-19:  
Guidance for governments on the use  
of digital technologies in education

**ACT THREE (OF THREE): GUIDANCE NOTES**

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# Guidance Note: Ensuring resilient connectivity<sup>1</sup>

## Context

Reliable and affordable connectivity is essential for users to benefit from distance learning. Due to the potential issues such as availability, affordability, and quality in marginalised environments, providing full connectivity for each school may not be feasible. In these circumstances, governments should explore alternative connectivity options and distance education delivery methods to ensure that the education system as a whole remains resilient. Where internet connectivity is available, it is also important to ensure that this is meaningful and allows teachers and students to pursue their educational activities without interruption.

Governments should address availability, affordability, and quality to promote connectivity for those living in marginalised environments.

- **Availability** — During crises and pandemics, students, teachers, and administrators depend heavily on access to the infrastructure needed to make distance learning possible.
- **Affordability** — Unless the available connectivity is affordable, the most marginalised will not be able to use the services. Therefore, addressing affordability must be prioritised in ways that still permit sustainable availability. Many initiatives opt to provide services to the most marginalised for free or extremely low charges which impacts the long-term sustainability of the initiatives.<sup>2</sup>
- **Quality** — Connectivity must be consistently available with sufficient bandwidth and limited disruption, which means providing connectivity through a resilient infrastructure with capacity sufficient to meet any pandemic-related increases in demand.

Governments can usefully take the following actions to address these issues:

- Governments should work together with mobile network operators and internet service providers to collaborate in offering affordable connectivity solutions for marginalised communities.
- Governments should expedite the allocation of additional spectrum to ensure stability and to meet increases in demand.
- Mobile network operators could provide the most marginalised with zero-rated access to essential services, such as educational materials.
- Educational institutions, such as Colleges and Universities, can contribute with data.<sup>3</sup>

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1 Lead authors Müge Haseki, Leon T. Gwaka, and Christopher S. Yoo.

2 Even though services must be affordable among the poor, connectivity initiatives need business models which enable them to be sustainable.

3 For instance, in South Africa, universities provide students with 30GB to facilitate distance learning.

Governments should develop an action plan for distance learning with respect to the level of connectivity in any given area. There are often three different levels of connectivity and accompanying delivery methods:

- **No internet connectivity** — Broadcasting classes through television and radio, printing and distributing class material.
- **Limited/unreliable internet connectivity** — Asynchronous classes using mobile phones or devices and possibly distributed storage.
- **Full internet connectivity** — Broadcasting videos through websites/portals/social media.

Many of the most marginalised communities are typically located in areas with limited to no Internet infrastructure. Governments can support alternative connectivity initiatives in these areas based on the availability of resources. These include:

- **Digital squares** — Digital village squares in India, for example, offers 28 standalone HiWEL stations and 23 stations for digital literacy training using the National Digital Literacy Mission's curriculum in a low resource environment.
- **Cyber caravans** — Mobile classrooms (known as cyber caravans) can be equipped with computers and broadband internet connection. The National Computer Board in Mauritius offers cyber caravans for communities in remote areas, allowing them to access the internet and participate in training programs with the devices and connectivity on board.
- **Portable wi-fi devices** — Another option is providing connectivity through portable wi-fi devices. Educators in areas with no connectivity in South Africa, for instance, were provided with wi-fi dongles that allowed them to conduct teaching and student support remotely.
- **Community networks** — When a commercial service is not feasible and a government's resources are limited, local communities can be encouraged to build their own networks. The Zenzeleni community network in South Africa, for instance, have provided a solar-powered wi-fi network to the homes of over 3000 people and 3 schools in an underserved community since 2012.
- **Public wi-fi hotspots** — Mawingu Networks create public wi-fi hotspots in hundreds of communities where low-income populations in Kenya can log in to pay-as-you-go accounts.

Governments should also consider the most appropriate available cost-effective technologies to provide Internet connection. These include the following:

- **Mobile connectivity** — This refers to connectivity through mobile network SIM cards.
- **TV White Space (TVWS)** — TV White Space refers to a set of frequencies in the wireless spectrum previously used by terrestrial television. The gaps created by the switch to digital broadcasting freed up part of the spectrum. Numerous efforts are underway exploring whether TVWS can be used to support broadband internet service.
- **Satellite (VSAT)** — Multiple providers are attempting to offer connectivity via two-way signals transmitted and received through an earth station satellite dish.
- **Off-the-shelf technologies** — These refer to plug and play connectivity solutions, such as wireless rural extensions (WiRE) which is a low-power rural wireless

network architecture that provides cellular connectivity using OpenBTS-based GSM microcells.<sup>4</sup>

In addition, most marginalised communities lack supporting infrastructure, such as electricity<sup>5</sup> (see *Guidance Note on electricity*) and anchor tenants that can provide shelter and security for digital technologies to increase their durability.

## Guidance

To achieve connectivity for education, we suggest that it is useful for governments to consider the following principles:

1. **Conduct comprehensive assessment of connectivity levels** to understand where connectivity gaps are and ensure data-driven planning.
2. **Develop complementary infrastructure, including reliable electricity**, before digital technologies are introduced in schools.
3. **Be technology agnostic** and consider the existing connectivity options before developing or integrating new technologies.
4. **Identify the local infrastructure problems** to select the most appropriate connectivity initiative to fund and support.
5. **Build a sustainable and scalable connectivity plan** from the beginning.
6. **Identify the challenges of the most marginalised learners** to access connectivity and come up with an action plan to address them.
7. **Leverage resources from other local and global initiatives** to develop and improve connectivity.
8. **Identify key stakeholders and their roles** in building resilient and affordable connectivity systems.

## Examples

Examples of interesting connectivity models for education from which important lessons, both positive and negative, can be learnt are profiled by the University of Pennsylvania's 1 World Connected project<sup>6</sup>:

- Zaya Learning Lab. Available at: [http://1worldconnected.org/wp-content/uploads/2017/12/052517\\_Zaya-Learning-Lab\\_FB-.pdf](http://1worldconnected.org/wp-content/uploads/2017/12/052517_Zaya-Learning-Lab_FB-.pdf).
- Maendeleo Foundation. Available at: <http://1worldconnected.org/case-study/maendeleo-foundation/>.
- Digital Village Squares. Available at: <http://1worldconnected.org/case-study/digital-village-squares/>.

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4 Dhananjay, A., Tierney, M., Li, J., & Subramanian, L. (2011). WiRE: A new rural connectivity paradigm. *ACM SIGCOMM Computer Communication Review*, 41(4), 462–463.

5 A detailed discussion on electricity is provided in a separate *Guidance Note* and discussed in *Section 10* of the Report.

6 <http://1worldconnected.org/>.

## Suggested further reading

- Andrew, T. N. and Petkov, D. (2003) The need for a systems thinking approach to the planning of rural telecommunications infrastructure, *Telecommunications Policy*, 27(1–2), 75–93.
- Graydon, M. and Parks, L. (2019) 'Connecting the unconnected': A critical assessment of U.S. satellite internet services, *Media, Culture & Society*, 0163443719861835.
- Gwaka, L. T., May, J. and Tucker, W. (2018) Towards low-cost community networks in rural communities: The impact of context using the case study of Beitbridge, Zimbabwe, *The Electronic Journal of Information Systems in Developing Countries*, 84(3), e12029.
- Heimerl, K., Hasan, S., Ali, K., Brewer, E. & Parikh, T. (2013, December) Local, sustainable, small-scale cellular networks. In *Proceedings of the Sixth International Conference on Information and Communication Technologies and Development: Full Papers*, Volume: 2–12.
- See Kuriyan, R., Nafus, D. and Mainwaring, S. (2012) Consumption, technology, and development: The 'poor' as 'consumer'. *Information Technologies & International Development*, 8(1): 1–12.
- Rich, M. J. and Pather, S. (2020) A response to the persistent digital divide: Critical components of a community network ecosystem, *Information Development*, 0266666920924696.
- UNHCR (no date) *Community-led connectivity assessing the potential of community network models in the context of forced displacement in East Africa*. Available at: <https://www.unhcr.org/innovation/wp-content/uploads/2020/05/Community-led-Connectivity-WEB052020.pdf>.

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Developed in collaboration with the University of Pennsylvania.



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