Closing the Gap: Youth Education, the Digital Divide, and the Global Pursuit of SDG 4

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Executive Summary

In an increasingly digital world, access to technology and the internet is no longer a luxury; it is a fundamental requirement for education, participation, and progress. For the global youth population, digital access determines whether they can attend class, apply for jobs, learn new skills, or make their voices heard. Yet today, over 2.7 billion people globally remain unconnected, and youth in underserved communities are among the hardest hit. This divide presents a direct obstacle to achieving **Sustainable Development Goal 4 (SDG 4)**, which calls for inclusive, equitable, and quality education for all.

At the core of this issue lies Sustainable Development Goal 4, which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Without urgent attention to the digital gap, progress toward this goal risks stalling or even reversing. While global advancements in technology have brought transformative tools into classrooms, they have also deepened existing inequalities. Youth without stable internet or access to basic technology are missing out on educational content, skill-building opportunities, and connections to global learning communities.

Global catastrophes, in particular the COVID-19 pandemic exposed and intensified these inequalities. As schools transitioned to online learning, those without adequate digital access were disproportionately affected. Many students dropped out or fell significantly behind, and in some regions, particularly in the Global South, learning losses became almost irreparable. But the consequences extend beyond academic performance. Limited access to digital learning reduces opportunities for economic mobility, job readiness, and civic engagement among youth, especially in marginalized communities.

Despite these challenges, young people have shown resilience and innovation. Across the globe, youth-led organizations, peer-to-peer learning networks, and grassroots initiatives are working to bridge the divide. From establishing community Wi-Fi hubs to developing open-source learning apps, youth are playing an active role in shaping inclusive education. Achieving SDG 4 requires more than simply distributing devices. It calls for a comprehensive effort involving governments, private sectors, NGOs, and educational institutions to create sustainable digital ecosystems that serve all youth. Education must be designed with equity in mind, ensuring that no young person is excluded due to where they live, how much money their family makes, or what technology they can access. The future of education, and the future of youth empowerment, depends on the collective ability to close the digital divide.

The Digital Divide and its Consequences

The digital divide refers to the gap between those who have access to modern information and communication technologies and those who do not. This encompasses physical access to the internet and devices as well as the skills (digital literacy) to use them effectively[1]. In practical terms, being on the advantaged side of the divide means having a reliable internet connection, a device like a computer or smartphone, and the know-how to navigate digital tools. Those on the disadvantaged side lack one or all of these elements. The divide often falls along existing socio-economic lines ; income level, location, gender, age, and education all influence who can get online[2]. For example, rural and low-income communities typically have far less internet access than urban or wealthier groups, and globally women and girls often have less access than men (the "gender digital divide"). In short, digital exclusion mirrors and amplifies broader inequalities in society.

SDG 4 and Education Targets: The digital divide poses a direct challenge to Sustainable Development Goal 4 (SDG 4), which aims for inclusive, equitable, quality education and lifelong learning for all. SDG 4 has specific targets, notably:

- 4.1: Free, equitable, and quality primary and secondary education for all children;
- 4.4: Relevant skills for employment & entrepreneurship (including technical and vocational skills);
- 4.a: Building safe, inclusive, and effective learning environments, including through technology.

Each of these targets is undermined by the digital divide:

- Impact on Free & Equitable Schooling (Target 4.1): A child cannot fully benefit from free primary or secondary education today if they lack access to digital resources. Schools increasingly use online materials, and during crises like the COVID-19 pandemic, connectivity became a lifeline for continuing classes. Yet massive numbers of students have been unable to connect. In 2020, when COVID-19 shut schools worldwide, at least one-third of schoolchildren (463 million children) could not access remote learning at all. This was mainly due to lack of internet at home or no available devices and content. Such children simply dropped out or fell behind while peers with online access kept learning. In vulnerable communities; remote rural areas, urban slums, refugee camps; students were left with no instruction for months[3]. This stark divide in access during school closures meant that the goal of equitable education for all (4.1) was severely compromised. Free public education in practice was not truly "accessible" if it required digital connectivity that poorer students didn't have. Even outside of pandemics, the internet now hosts a wealth of educational content (lessons, open courses, exam prep, etc.). Students who can get online easily augment their classroom learning, while those who cannot are limited to whatever books or teaching are available locally. This perpetuates disparities in learning outcomes, with offline students often lagging behind. The UN Secretary-General's progress report

[1] "TVETipedia Glossary." 2016. Unesco.org. 2016. https://unevoc.unesco.org/home/TVETipedia+Glossary/lang=en/show=term/term=Digital+divide
[2] "TVETipedia Glossary." 2016. Unesco.org. 2016. https://unevoc.unesco.org/home/TVETipedia+Glossary/lang=en/show=term/term=Digital+divide
[3] "Two Thirds of the World's School-Age Children Have No Internet Access at Home, New UNICEF-ITU Report Says." 2020. Unicef.org. 2020. https://www.unicef.org/press-releases/two-thirds-worlds-school-age-children-have-no-internet-access-home-new-unicef-itu

bluntly warned that "the digital divide will widen existing gaps in equality with regard to education"[4] if not addressed.

- Impact on Skills & Employment (Target 4.4): SDG 4.4 calls for youth to develop relevant skills for decent work, including technical and vocational skills. In the 21st-century economy, digital skills are core employment skills. A lack of digital access translates into a lack of digital literacy; youths who grow up offline are deprived of opportunities to learn coding, online communication, digital content creation, or even basic computer use. This directly hampers their job prospects in an increasingly digital job market[5] Even many traditional trades and professions now require some digital proficiency (for example, farmers using smartphones for market information, or nurses using telehealth systems). Globally, digital skill attainment is far behind what's needed: in 2023 data, fewer than 40% of youth in high- and upper-middle-income countries were even minimally proficient in digital literacy, and rates are presumed far lower in low-income countries[6] In many low-income regions, most young people have never touched a computer. If this gap persists, millions of youth will reach adulthood without the skills that employers demand, undermining SDG 4.4. Moreover, entrepreneurship and innovation increasingly thrive online. Without connectivity, young would-be entrepreneurs cannot access online markets, finance, or training. The "digital skills gap" therefore threatens to entrench economic inequality: connected youth move ahead into better jobs and business opportunities, while their disconnected peers are left behind in low-paying, unskilled work or joblessness.

- Impact on Learning Environments (Target 4.a): SDG 4.a emphasizes providing safe, inclusive, and effective learning environments for all, which today includes having schools equipped with technology and connectivity. The digital divide highlights that many schools (especially in developing regions) lack basic infrastructure like electricity, internet, and computers. This is a barrier to creating technology-enabled learning spaces. Globally, there has been progress; by 2022, about 69% of upper-secondary schools had internet access, but only 44% of primary schools did. In the poorest regions, the situation is dire: in sub-Saharan Africa, less than half of primary and lower secondary schools have access to electricity, the Internet, or computers[7] Many students in these regions study in schools without lights or running electricity, let alone web access. Without power or internet, initiatives like digital libraries, online educational software, or virtual science labs cannot be utilized. The result is that children in these schools are denied the enriched learning environments that connected schools elsewhere enjoy. Safe and inclusive education in the 21st century also means preparing learners for a digital world; something impossible to do in an unconnected classroom. Furthermore, the digital divide can affect safety and inclusion: for instance, lack of assistive technologies for students with disabilities (who might need specialized software or devices) means these students don't have an inclusive experience

[4] "Goal 4 | Department of Economic and Social Affairs." 2025. Un.org. 2025. https://sdgs.un.org/goals/goal4
[5] RK News Desk. 2025. "Bridging the Digital Divide: Rohingya Youth and the Fight for Computer Literacy." Rohingya Khobor . March 11, 2025. https://rohingyakhobor.com/bridging-the-digital-divide-rohingya-youth-and-the-fight-for-computer-literacy
[6] "Helping Youth Benefit from Inclusive, Digital, and Green Development: A Goal to Remember on International Youth Day." 2023. World Bank Blogs. 2023. https://blogs.worldbank.org/en/education/helping-youth-benefit-inclusive-digital-and-green-development-goal-remember-international
[7] "Goal 4 | Department of Economic and Social Affairs." 2025. Un.org. 2025. https://sdgs.un.org/goals/goal4

(connecting also to SDG 4.a's call for disability-accessible facilities). In summary, schools on the wrong side of the digital divide cannot offer modern, tech-enabled education, putting their students at a disadvantage. Investments in school connectivity, electrification, and devices are thus central to achieving target 4.a.

In all the above ways, the digital divide perpetuates and even worsens educational inequalities. It creates a vicious cycle: disadvantaged groups (the poor, rural, female, disabled, conflict-affected) have less access to technology, which leads to poorer educational outcomes; lower quality education, higher dropout rates, and fewer skills. Those poorer outcomes then reinforce the disadvantage, as these youths struggle to compete academically or economically, widening the gap between them and more privileged, connected learners[8] .The promise of SDG 4 is that every child and young person should have an equitable chance to learn and thrive. But without digital inclusion, that promise rings hollow in a world where so much of knowledge and opportunity is mediated online. As UNICEF's Executive Director put it, the lack of connectivity is "more than a digital gap; it is a digital canyon" that "prevents children and young people from competing in the modern economy… and in the event of school closures, it causes them to lose out on education". In other words, digital exclusion today can cost the next generation their futures. Conversely, bridging the digital divide is pivotal for educational equity: it would help level the playing field so that a child in a remote village can access the same information and learning as a child in a city, and so that no youth is excluded from the knowledge society due to where they live or what gender they are. Ensuring universal affordable internet access, providing devices, and teaching digital skills must be viewed as integral components of the education agenda if SDG 4 is to be achieved.

The digital divide translates into starkly unequal access to education, especially evident during crises like pandemics, natural disasters, or conflicts when in-person schooling is disrupted. During the COVID-19 pandemic, education shifted to remote learning almost overnight for billions of students, but millions of youth were effectively shut out of school because they lacked connectivity or devices. At the peak of school closures in 2020, 1.6 billion learners worldwide were affected, and remote instruction became the default in most countries. However, at least 463 million children; roughly one-third of students globally; could not be reached by remote lessons via internet or broadcast, largely due to the digital divide.[9]In low-income regions, the situation was even worse. For example, in sub-Saharan Africa, 82% of learners lacked internet access at home and 89% had no household computer, making online schooling nearly impossible. Over 50 million students in Africa also live in areas not served by mobile networks at all[10] These children had no means to attend virtual classes or access digital educational content. By contrast, students in better-resourced environments (with home internet, laptops, and online learning platforms) could continue their education, albeit sometimes at reduced effectiveness. The result is that COVID-19 school closures deepened educational inequity: many disconnected youth lost an entire year or more of

[8] "Two Thirds of the World's School-Age Children Have No Internet Access at Home, New UNICEF-ITU Report Says." 2020. Unicef.org. 2020. https://www.unicef.org/press-releases/two-thirds-worlds-school-age-children-have-no-internet-access-home-new-unicef-itu

[9] "One Year into COVID-19 Education Disruption: Where Do We Stand?" 2023. Unesco.org. 2023. https://www.unesco.org/en/articles/one-year-covid-19-education-disruption-where-do-we-stand

[10] UNESCO. (2020, April 21). *Startling Digital Divides in Distance Learning Emerge*. Www.unesco.org. https://www.unesco.org/en/articles/startling-digital-divides-distance-learning-emerge

learning, while connected peers kept progressing.[11] This exclusion from remote education for millions of students has been one of the most damaging consequences of the global digital divide.

The educational divide caused by lack of digital access has translated into gaps in learning outcomes and achievement. Students with robust digital access have been able to maintain or even accelerate their learning using online resources, while those without access have fallen further behind, sometimes irreversibly. Emerging evidence from the COVID period shows that where remote learning was effective, learning losses were mitigated; but where digital access was absent, learning loss was severe. Globally, pandemic-related disruptions caused "lost learning… in months," not just weeks. In fact, learning poverty; defined as inability to read and understand a simple text by age 10; has spiked to an estimated 70% in low- and middle-income countries, up from 57% pre-pandemic. This huge increase (a one-third jump in learning poverty) is attributed to prolonged school closures combined with lack of effective remote learning options for many children. [12] Disadvantaged and offline students suffered the largest learning losses. A joint World Bank-UNESCO-UNICEF report in 2022 warned that "children from lower socioeconomic backgrounds and other disadvantaged groups are suffering larger learning losses" and that inequitable access to remote learning has worsened learning inequalities. We now see a widening gap in academic proficiency: youths with internet access could continue lessons, engage in digital self-study, or get tutoring online, whereas those without access often learned little or nothing for long periods. In some regions, this has set students back by months or even years. One study estimated that in sub-Saharan Africa, short-term COVID-related school closures led to up to one full year of learning lost, and potentially more in the long term if mitigations fail.[13] Even within countries like the United States, research showed that students who had computers and internet at home spent significantly more hours on learning during COVID than those who lacked technology. Those extra hours translate to better retention of material and progress. Meanwhile, students without access couldn't complete assignments or attend virtual classes, leading to widening achievement gaps. For instance, a U.S. survey found one-third of teens could not complete homework due to no computer or internet at home[14] If unaddressed, this will produce a generation where educational attainment – literacy, numeracy, high-school completion – is much lower for the digitally excluded, undermining the overall SDG 4 goal of quality education for all.

Another challenge in a digitally divided world is that teachers and schools in underserved areas often lack the training, tools, and content to utilize technology for education. Even where infrastructure exists, the human capacity to use it effectively may lag behind. Many teachers, especially in low-income countries,

[11] Group, World Bank. 2023. "70% of 10-Year-Olds Now in Learning Poverty, Unable to Read and Understand a Simple Text." World Bank. World Bank Group. July 25, 2023. https://www.worldbank.org/en/news/press-release/2022/06/23/70-of-10-year-olds-now-in-learning-poverty-unable-to-read-and-understand-a-simple-text

[12] Group, World Bank. 2023. "70% of 10-Year-Olds Now in Learning Poverty, Unable to Read and Understand a Simple Text." World Bank. World Bank Group. July 25, 2023. https://www.worldbank.org/en/news/press-release/2022/06/23/70-of-10-year-olds-now-in-learning-poverty-unable-to-read-and-understand-a-simple-text

[13] Angrist, Noam, Andreas de Barros, Radhika Bhula, Shiraz Chakera, Chris Cummiskey, Joseph DeStefano, John Floretta, Michelle Kaffenberger, Benjamin Piper, and Jonathan Stern. 2021. "Building Back Better to Avert a Learning Catastrophe: Estimating Learning Loss from COVID-19 School Shutdowns in Africa and Facilitating Short-Term and Long-Term Learning Recovery." International Journal of Educational Development 84 (July): 102397. https://doi.org/10.1016/j.ijedudev.2021.102397.

[14] Kolawole Ogundari. 2023. "Student Access to Technology at Home and Learning Hours during COVID-19 in the U.S." Educational Research for Policy and Practice 22 (3): 443–60. https://doi.org/10.1007/s10671-023-09342-7.

have not received training in digital pedagogy or even basic ICT skills. This was highlighted during COVID-19 when teachers suddenly had to conduct classes online. In regions with strong ICT infrastructure, teachers still struggled to adapt; in regions with poor infrastructure, it was often "even more difficult or impossible" for teachers to transition to remote teaching. Globally, prior to the pandemic, only 64% of primary and 50% of secondary teachers in sub-Saharan Africa had received minimum required training, and such training often "does not include ICT skills"The result is that even if computers or tablets are provided in a school, teachers may not know how to integrate them into lessons. In underserved schools, it's common to find computer labs lying idle or under-used due to lack of teacher confidence and training. Additionally, teachers in communities on the wrong side of the digital divide often lack access to digital teaching content; for example, they cannot download updated curricula, access online educational resources, or participate in e-learning themselves for professional development. In contrast, teachers in well-connected schools can enrich their lessons with multimedia content, use online platforms to assign homework, and join communities of practice to improve their methods. The gap in teacher preparedness and content access further exacerbates educational inequalities. When remote or blended learning is required, under-trained teachers and analog teaching methods leave students in disadvantaged areas at a further loss. Recognizing this, many calls have been made for investing in teacher capacity as part of closing the digital divide. Policymakers note that "teachers require training and support on remote teaching and available technologies", without which even donated devices won't translate into better learning.[15] In summary, bridging the digital divide in education isn't only about hardware; it requires building the soft infrastructure of teacher skills and locally relevant content, so that all youth can benefit from digital learning opportunities. Without such support, introducing technology could even widen the divide (if, say, only elite schools know how to leverage it). Thus, a key challenge is ensuring teachers in marginalized areas are equipped to deliver 21st-century education.

The above challenges and cases make clear that the digital divide is not a peripheral issue.It is fundamental to whether today's youth can obtain a quality education and equal opportunities. The consequences of leaving the divide in place are severe: a generation of students in marginalized communities with permanently lower educational attainment, reduced job prospects, and diminished ability to participate in civic life. Education has always been a great equalizer; digital education could either amplify that; or, if access is unequal, it could vastly increase inequity. The COVID-19 crisis served as a wake-up call, revealing the depth of the divide. As we move forward, there is a growing consensus that closing the digital gap for youth is essential to meeting SDG 4.

Youth-led Innovations and Responses

Youth across the globe are transforming from passive recipients into powerful solutions-makers in bridging the digital divide. Their initiatives range from free learning apps and peer-to-peer tutoring platforms to solar-powered tablets, demonstrating remarkable grassroots creativity and resilience. One standout effort is Catrobat which is an open-source, free visual coding platform designed for teenagers using only smartphones. It enables youth globally to create, share, and learn coding skills independently

[15] UNESCO. 2021. "One Year into COVID-19 Education Disruption: Where Do We Stand? | UNESCO." Www.unesco.org. March 19, 2021. https://www.unesco.org/en/articles/one-year-covid-19-education-disruption-where-do-we-stand.

of PCs or laptops. Since its inception around 2010, Catrobat has grown to more than 700,000 users across 180 countries, offers accessibility for learners with impairments, and includes extensions for robotics and hardware exploration. [16] This empowers young creators to engage in digital production regardless of formal infrastructure.

In Africa, SuaCode is a smartphone-based coding course that reached participants across 37 countries. Through an eight-week online format delivered via smartphones, learners collaborated, submitted assignments, and received peer and facilitator support. Among the 210 admitted students, 72 % completed the course, and a year later many had developed apps, written tutorials, and continued building tech skills [17] These innovations illustrate how youth leverage accessible platforms to build digital fluency across continents.

Real-world solutions led by young innovators are making concrete impacts. In Mozambique, Community Tablet was created by entrepreneur Dayn Amade. It consists of mobile, solar-powered LCD screens which are essentially interactive digital classrooms that travel by truck or even donkey. These solar tablets bring educational content, health messaging, and quizzes to rural communities. Over three years, this initiative reached nearly 1,900 people across 31 districts, improving outcomes such as voter turnout, contraceptive use, and bank account adoption[18] . During the COVID-19 pandemic, the project also delivered health-related information, expanding access where the internet access was scarce.

Arizona State University's SolarSPELL system also exemplifies youth-driven deployment via education networks. SolarSPELL offers portable, solar-powered digital libraries that work offline via Wi-Fi. As of 2024, nearly 600 units have been distributed across 15 countries, reaching over 300,000 people, with training for users included[19] Notably, the system was recently adopted domestically in Phoenix by crisis response teams who now provide low-literacy, offline educational materials to trauma victims, modernizing paper-based methods SolarSPELL was acknowledged as "Best in Show" at SXSW 2025, recognizing its innovative impact.

Another compelling initiative is Powering Potential's SPARC program in Tanzania. This youth-oriented nonprofit installs solar-powered Raspberry Pi labs with offline content includingKhan Academy videos, Scratch, RACHEL libraries while also providing training to teachers and students. Their Pi-oneer program distributes Raspberry Pi units pre-loaded with educational content and solar charging units. These labs reach rural schools and extend digital learning access in off-grid areas. [20]

Youth are not only delivering tools, they are also advocating for systemic change. The Youth Activism Project (YAP) empowers young people to influence education and civic policy. Its School Girls Unite initiative, formed in 2004, connected students in the U.S. and Mali advocating for girls' education and

[16] Luhana, K. K., Mueller, M., Schindler, C., Slany, W., & Spieler, B. (2018). Catrobat: Extremely large-scale and long-term visual coding project relying purely on smartphones. arXiv. https://doi.org/10.48550/arXiv.1808.06292
[17] Boateng, G., Annor, P. S., & Kumbol, V. (2021). Teaching coding online to Africans using smartphones (SuaCode Africa). arXiv. https://doi.org/10.48550/arXiv.2107.12257
[18] Blackmon, S. (2021, March 2). Solar tablets educating communities in Mozambique. The Borgen Project. https://borgenproject.org/solar-tablets
[19] Axios. (2025, May 1). ASU's SolarSPELL wins at SXSW and spreads from Pacific Islands to Phoenix. *Axios Phoenix*. https://www.axios.com/local/phoenix/2025/05/01/asu-solarspell-libraries-global-impact
[20] Power Potential | National Energy System Operator. (2025). National Energy System Operator (NESO). https://www.neso.energy/about/our-projects/power-potential

gender equity. They raised scholarships, conducted community engagement, and influenced government policy, contributing to an increase in U.S. basic education funds for developing nations, increasing from $400 million in 2005 to $740 million in 2008. [21]

In the United States, the Digital Ambassadors pilot by IDRA and ARISE Adelante trains youth to teach digital skills to families and community members. This cross-age tutoring model builds bridges, improves academic and attendance outcomes, strengthens school-community ties, and fosters youth as leaders in digital equity efforts. [22] By positioning youth as both learners and educators, the program catalyzes policy attention and resource allocation to student-led digital inclusion.

These examples affirm that youth are not merely victims of the digital divide, but they are key architects of solutions. From Catrobat and SuaCode unlocking coding possibilities via smartphones, to Community Tablet, SolarSPELL, and Powering Potential delivering offline digital resources with solar infrastructure; these grassroots innovations reflect youth agency and ingenuity.

Youth advocacy further amplifies impact through groups like YAP influencing funding and education policy, and Digital Ambassadors modeling digital leadership for communities. These efforts prove that with adequate support, young people drive equitable access, cultural relevance, and sustainable ed-tech solutions.

Global Stakeholders

Closing the digital divide for youth education is not the responsibility of a single entity. It requires the coordinated efforts of multiple global stakeholders. Governments, multilateral organizations, the private sector, non-governmental organizations (NGOs), and youth themselves all play pivotal roles in expanding digital access and realizing the vision of SDG 4: inclusive and equitable quality education for all.

Governments and Public Institutions

Governments are key enablers of digital inclusion, tasked with expanding internet infrastructure, funding devices and connectivity, and integrating digital literacy into national curricula. For example, India's Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA) aims to provide basic digital literacy to millions in rural areas. [23]Similarly, Kenya's Digital Literacy Programme targets public primary schools with tablets and teacher training. [24] However, challenges such as limited budgets, weak implementation, and inconsistent access to electricity continue to constrain these programs, especially in the Global South.

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[21] IDRA. (2024, August 15). Youth-centered programs help to bridge the digital divide in underserved communities. Intercultural Development Research Association. https://www.idra.org/resource-center/youth-centered-programs-help-to-bridge-the-digital-divide-in-underserved-communities

[22] IDRA. (2024, August 15). Youth-centered programs help to bridge the digital divide in underserved communities. Intercultural Development Research Association. https://www.idra.org/resource-center/youth-centered-programs-help-to-bridge-the-digital-divide-in-underserved-communities

[23] "Pmgdisha." 2025. Pmgdisha.in. 2025. https://www.pmgdisha.in/.

[24] "Digital Literacy Programme(DLP) | Ministry of ICT and the Digital Economy." 2024. Ict.go.ke. 2024. https://ict.go.ke/digital-literacy-programmedlp.

Multilateral Organizations

The United Nations and affiliated organizations have taken a central role in global digital equity efforts. UNESCO launched the *Global Education Coalition* in response to the COVID-19 pandemic to support remote learning and mitigate educational disruption in over 100 countries.[25] UNICEF's *Giga* initiative, in partnership with the International Telecommunication Union (ITU), aims to connect every school to the internet by 2030, focusing particularly on least developed countries. The World Bank has also committed over $25 billion to education technology projects since 2020, including platforms for hybrid learning and investments in teacher training[26]

Private Sector and Technology Companies

Private technology companies are increasingly influential in digital education initiatives. Google's *Internet Saathi* program has trained over 30 million rural women and girls in India in digital skills , while Microsoft's *Airband Initiative* supports broadband access in underserved regions of Africa and Latin America. [27] These companies also provide productivity tools and virtual classroom platforms, such as Google Workspace for Education and Microsoft Teams. While their contributions are significant, critics raise concerns about data privacy, equity of access, and potential dependency on corporate platforms.

Non-Governmental Organizations and Civil Society

NGOs help fill gaps in public infrastructure and offer community-based solutions tailored to local needs. The Global Partnership for Education (GPE), for instance, funds country-led plans to scale digital learning, teacher training, and inclusive content. Other NGOs like *Education Cannot Wait* and *BRAC* deliver low-cost devices, offline learning modules, and digital learning hubs to displaced and underserved youth. Local civil society actors are often more agile and trusted within communities, allowing for culturally responsive interventions.

Youth as Change Agents

Youth are increasingly leading digital inclusion efforts themselves. Across Africa, Asia, and Latin America, young innovators are launching grassroots coding clubs, peer-learning networks, and rural internet cooperatives. These initiatives not only bridge access gaps but foster leadership and community resilience. Empowering youth as co-creators, rather than passive recipients of digital tools, leads to more sustainable, scalable solutions.

Systematic Solutions

To achieve SDG 4 (inclusive, equitable quality education) in an age of rapid technological change, closing the digital divide is imperative. Girls, rural youth and those in low-income countries are hardest hit. In response, education policy must treat internet and technology access as fundamental rights, not luxuries,

[25] "UNESCO Strategic Objectives." 2023. Unesco.org. 2023. https://www.unesco.org/en/strategic-objectives.
[26] "Overview." 2018. World Bank. 2018. https://www.worldbank.org/en/topic/education/overview.
[27] "Microsoft Airband Initiative | Microsoft CSR." 2025. Microsoft. 2025. https://www.microsoft.com/en-us/corporate-responsibility/airband-initiative.

and deliberately build digital inclusion into all levels of planning. The following recommendations; drawn from UN agencies, think tanks, and recent global initiatives; outline a comprehensive path forward.

Action: Enshrine connectivity as a right and partner across sectors to provide it. Governments should commit to universal high-speed internet and device access for learners through policy, regulation and investment. For example, UNESCO notes that 43% of households worldwide still lack internet access, with cost a major barrier. [28] Policy measures could include subsidizing data plans for education, legislating affordable broadband as an essential service, and supplying free Wi-Fi in public spaces (libraries, community centers, etc.). Some countries (e.g. India) are already "guarantee[ing] the right to internet access to the entire population" via public Wi-Fi networks. [29]International initiatives can also help: the ITU-UNICEF "Giga" programme, for instance, has mapped over 800,000 schools in 30 countries and works with governments, industry and donors to mobilize blended public–private funding for school connectivity unicef.org. Through Giga, universal internet becomes a proven investment; connectivity directly enables digital learning, workforce training and entrepreneurship opportunities for youth unicef.org.

Governments should treat internet access and devices as education rights. This may involve writing connectivity into constitutions or national education laws. Policymakers can establish universal service funds or public broadband utilities to extend networks into underserved areas.

Partner with telecoms and industry to subsidize or donate data and devices for schools. UNESCO's Global Education Coalition highlights telecom operators (e.g. Orange, Vodafone) waiving data charges for educational platforms, signaling that free or low-cost internet is both feasible and necessary for equity Such partnerships should be expanded.

Invest in devices alongside connectivity. Governments and NGOs should supply laptops/tablets to poor and rural schools. For example, UNESCO and partners dispatched 50,000 Chromebooks and tens of thousands of tablets to Ukrainian schools in conflict zones to keep children learning. [30] Device-provision campaigns should be designed as part of emergency preparedness (stockpiling equipment for crises) and long-term inclusion. Importantly, hardware support must include necessary accessories (chargers, protective cases) identified in field research as critical to usability.

Subsidize local R&D and manufacturing. Governments and donors can fund startups and universities to develop affordable learning devices and software. This could include compact tablets for remote schools, durable satellite receivers, or solar chargers for off-grid areas. Local creation ensures products match cultural, linguistic and environmental conditions.

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[28] "Global Education Coalition Facilitates Free Internet Access for Distance Education in Several Countries." 2023. Unesco.org. 2023. https://www.unesco.org/en/articles/global-education-coalition-facilitates-free-internet-access-distance-education-several-countries.

[29] "Review of Technology-Based Interventions to Address Child Marriage and Female Genital Mutilation." n.d. Accessed August 8, 2025. https://www.unicef.org/media/137586/file/Tech-based-Interventions-Adress-Harmful-Practices-2023-India-v2.pdf#:~:text=government%20has%20increased%20its%20efforts,the%20mobile%20access%20gap%20between.

[30] "Education in Ukraine: Over $51 Million in Grants and In-Kind Support Announced from UNESCO, GPE, Google and Microsoft." 2023. Unesco.org. 2023. https://www.unesco.org/en/articles/education-ukraine-over-51-million-grants-and-kind-support-announced-unesco-gpe-google-and-microsoft.

Focus on open educational resources (OER) and local language content: Instead of buying proprietary curricula, investment should support creation of open textbooks, apps and MOOCs in local languages. UNESCO emphasizes that tech-enabled models must “leave no one behind,” so materials should reflect local contexts and curricula. Publicly-funded content libraries and teacher development platforms can be shared across regions to reduce costs.

Pilot community broadband and learning hubs: In places where home access is scarce, establish community Wi-Fi centers in schools or libraries. Youth-led initiatives have successfully set up solar-powered Wi-Fi kiosks and coding clubs in underserved villages, demonstrating grassroots scalability. Governments should co-invest in such initiatives, possibly through education grants to NGOs, to create inclusive digital learning spaces.

Action: Treat digital skills as a fundamental competency from early grades: Every child should graduate school being able to use technology safely and effectively. To do this, curricula must explicitly include digital and media literacy outcomes, alongside math and language learning. As CSIS analysts conclude, “the earlier digital education begins, the more attainable a high degree of digital literacy is” csis.org. National education standards should be revised so that, for example, basic coding, internet research, and online communication skills are taught throughout primary and secondary schooling.

Develop national digital skills frameworks: Ministries of education (with UNESCO/ITU guidance) should adopt standardized frameworks (e.g. the UNESCO Digital Literacy Skills Framework) to define what students need to know at each grade. These frameworks can be integrated into existing subjects (e.g. using math class to teach data interpretation) or added as new modules.

Train and support teachers: As one report warns, many school systems currently “lack the proper infrastructure, technological equipment, teacher training or learning benchmarks” to teach digital skills csis.org. Massive programs are needed to upskill teachers: pre-service courses, in-service workshops, and online peer communities. Public–private partnerships can supply free digital literacy training (as Microsoft’s Digital Literacy curriculum has done in some countries) csis.org. Donors should fund teacher development as part of EdTech investments, ensuring educators are comfortable with both hardware and pedagogy.

Ensure equity in digital literacy: Pay special attention to marginalized groups. For instance, girls and rural students often lack internet access; digital literacy programs should include offline pedagogies (e.g. mobile phone labs, community tech mentors) and mentorship for girls in STEM. UNESCO stresses that technology in education must be equitable and contextually appropriate, leaving “no one behind” unesco.org. Culturally relevant examples and content will help engage diverse learners.

Promote media and information literacy: Digital literacy isn’t just about tools, but about critical thinking online. Curricula should also teach students to discern misinformation, protect their privacy, and use the internet responsibly. Embedding these topics will help youth use technology to empower themselves rather than fall prey to scams or bias.

Action: Involve young people as architects of education technology: Youth are both avid technology users and primary stakeholders in education reform. Formal policy-making should include youth representatives to ensure programs reflect their needs. UNESCO’s SDG4 Youth & Student Network, for

instance, is a global platform to “ensure [young people’s] meaningful participation in shaping global education policies” unesco.org. Member organizations routinely publish policy briefs and hold forums on topics like digitalization and inclusion, demonstrating that youth engagement enriches policy.

Include youth in governance bodies: National education agencies, ICT policy councils or digital skills committees should have seats for youth-led organization leaders or student representatives. Likewise, when designing national EdTech plans or PPP projects, run youth consultations or hackathons to gather ideas on what tools and content are most needed. This bottom-up approach can surface innovations and build trust: UNICEF notes that “Building on the importance of youth engagement,” initiatives like Generation Unlimited empower young innovators to shape digital learning pathways unicef.org.

Support youth-led projects: Young people often pioneer solutions: from peer-to-peer coding clubs and open-source learning apps in Southeast Asia to community Wi-Fi mesh networks in Latin America. Governments and donors can offer seed grants or challenge prizes for student or youth-entrepreneur EdTech projects. Involving youth in program design makes interventions more relevant; for example, having adolescents help develop app interfaces ensures they are user-friendly for that age group. Education 2030 advocates note that leveraging “the positive impacts of digitalization in education” requires youth empowerment, digital capacity building and “intergenerational collaboration” unesco.org.

Establish emergency connectivity plans: Education ministries should partner with telecom regulators to reserve or ramp up bandwidth for education during crises. Investments in satellite connectivity or portable hotspots can create redundancy. For instance, UNESCO and UNICEF facilitated shipments of 50,000 laptops and mobile internet devices to Ukrainian schools during the war unesco.org. Such planning (and financing pools like the SDG4 emergency fund) ensures that even if regular schools are disrupted, students can connect to lessons from safe shelters or homes.

Develop digital learning platforms and content ahead of time: Rather than scrambling to record lessons after an outbreak, countries should create open digital libraries of curricula (online and offline) in advance. These platforms should be interoperable across schools and movable to students’ homes. UNICEF notes that during COVID, some countries could rapidly launch televised or online classes because they already had open-source materials; others lost months catching up. Sustained R&D in distance-learning pedagogy (radio lessons, apps that work offline, SMS tutoring) should be a permanent part of education budgets.

Train educators in crisis pedagogy: Teacher training must include modules on remote instruction and flexible scheduling. Educators should practice worst-case drills (e.g. what to do if schools close) and learn to use multiple modes (paper packets, radio, video calls) to reach students. Evidence from Ukraine and elsewhere shows that teachers with even basic tech skills can adapt to online tutoring or texting support if given the tools in advance.

Bridging the digital divide is not optional; it is the foundation for a more equal, educated future unesco.org. As global experts emphasize, technology should be deployed as a tool for inclusion, not a new frontier for inequality. UN agencies and think tanks agree: achieving SDG 4 requires ambitious, coordinated action to connect every learner, adapt education to local realities, and empower youth as co-creators of their education. By guaranteeing connectivity, investing in relevant edtech, teaching digital

skills, involving young people, and building resilient systems, governments and partners can ensure that no child is left behind when the world goes online unesco.org. The stakes are high; but the potential rewards are even higher: with every student brought into the digital fold, the promise of universal quality education comes one step closer to reality.

Works Cited

Angrist, N., de Barros, A., Bhula, R., Chakera, S., Cummiskey, C., DeStefano, J., Floretta, J., Kaffenberger, M., Piper, B., & Stern, J. (2021). Building back better to avert a learning catastrophe: Estimating learning loss from COVID-19 school shutdowns in Africa and facilitating short-term and long-term learning recovery. *International Journal of Educational Development*, *84*, 102397. https://doi.org/10.1016/j.ijedudev.2021.102397

Boehm, J. (2025, May). *ASU solar-powered libraries aid Arizona, Africa and beyond*. Axios; Axios Phoenix. https://www.axios.com/local/phoenix/2025/05/01/asu-solarspell-libraries-global-impact

Digital Literacy Programme(DLP) | Ministry of ICT and the Digital Economy. (2024). Ict.go.ke. https://ict.go.ke/digital-literacy-programmedlp

Education in Ukraine: over $51 million in grants and in-kind support announced from UNESCO, GPE, Google and Microsoft. (2023). Unesco.org. https://www.unesco.org/en/articles/education-ukraine-over-51-million-grants-and-kind-support-announced-unesco-gpe-google-and-microsoft

Global Education Coalition facilitates free internet access for distance education in several countries. (2023). Unesco.org. https://www.unesco.org/en/articles/global-education-coalition-facilitates-free-internet-access-distance-education-several-countries

Goal 4 | Department of Economic and Social Affairs. (2025). Un.org. https://sdgs.un.org/goals/goal4#:~:text=Target%204,are%20connected%20to%20the%20internet

Group, W. B. (2023, July 25). *70% of 10-Year-Olds now in Learning Poverty, Unable to Read and Understand a Simple Text*. World Bank; World Bank Group. https://www.worldbank.org/en/news/press-release/2022/06/23/70-of-10-year-olds-now-in-learning-poverty-unable-to-read-and-understand-a-simple-text#:~:text=Prolonged%20school%20closures%20and%20unequal,markets%20and%20more%20complex%20societies

Helping youth benefit from inclusive, digital, and green development: a goal to remember on International Youth Day. (2023a). World Bank Blogs. https://blogs.worldbank.org/en/education/helping-youth-benefit-inclusive-digital-and-green-development-goal-remember-international#:~:text=Unfortunately%2C%20a%20significant%20skills%20gap,Figure%201

Helping youth benefit from inclusive, digital, and green development: a goal to remember on International Youth Day. (2023b). World Bank Blogs. https://blogs.worldbank.org/en/education/helping-youth-benefit-inclusive-digital-and-green-development-goal-remember-international#:~:text=Unfortunately%2C%20a%20significant%20skills%20gap,Figure%201

Kolawole Ogundari. (2023). Student access to technology at home and learning hours during COVID-19 in the U.S. *Educational Research for Policy and Practice*, *22*(3), 443–460. https://doi.org/10.1007/s10671-023-09342-7

Kumar, L. K., Mueller, M., Schindler, C., Slany, W., & Spieler, B. (2018). *Rock bottom, the world, the sky: Catrobat, an extremely large-scale and long-term visual coding project relying purely on smartphones*. ArXiv.org. https://arxiv.org/abs/1808.06292

Microsoft Airband Initiative | Microsoft CSR. (2025). Microsoft. https://www.microsoft.com/en-us/corporate-responsibility/airband-initiative

Overview. (2018). World Bank. https://www.worldbank.org/en/topic/education/overview

Philipp, J. (2021, March 2). *How Solar Tablets Are Educating Communities in Mozambique - The Borgen Project*. The Borgen Project. https://borgenproject.org/solar-tablets

Pmgdisha. (2025). Pmgdisha.in. https://www.pmgdisha.in/

Power Potential | National Energy System Operator. (2025). National Energy System Operator (NESO). https://www.neso.energy/about/our-projects/power-potential

Promising uses of technology in education in poor, rural and isolated communities around the world. (2024). World Bank Blogs.

https://blogs.worldbank.org/en/education/education-technology-poor-rural#:~:text=1,are%20most%20likely%20to%20work

Review of Technology-Based Interventions to Address Child Marriage and Female Genital Mutilation. (n.d.). Retrieved August 8, 2025, from https://www.unicef.org/media/137586/file/Tech-based-Interventions-Adress-Harmful-Practices-2023-India-v2.pdf#:~:text=government%20has%20increased%20its%20efforts,the%20mobile%20access%20gap%20between

RK News Desk. (2025, March 11). *Bridging the Digital Divide: Rohingya Youth and the Fight for Computer Literacy*. Rohingya Khobor . https://rohingyakhobor.com/bridging-the-digital-divide-rohingya-youth-and-the-fight-for-computer-literacy/#:~:text=The%20Importance%20of%20Computer%20Skills,for%20Rohingya%20Youth

TVETipedia Glossary. (2016). Unesco.org. https://unevoc.unesco.org/home/TVETipedia+Glossary/lang=en/show=term/term=Digital+divide#:~:text=The%20digital%20divide%20can%20be,social%20groups%20or%20geographic%20location

Two thirds of the world's school-age children have no internet access at home, new UNICEF-ITU report says. (2020a). Unicef.org. https://www.unicef.org/press-releases/two-thirds-worlds-school-age-children-have-no-internet-access-home-new-unicef-itu#:~:text=%E2%80%9CThat%20so%20many%20children%20and,%E2%80%9D

Two thirds of the world's school-age children have no internet access at home, new UNICEF-ITU report says. (2020b). Unicef.org. https://www.unicef.org/press-releases/two-thirds-worlds-school-age-children-have-no-internet-access-home-new-unicef-itu#:~:text=NEW%20YORK%2FGENEVA%2C%C2%A01%20December%C2%A02020%C2%A0%E2%80%93%C2%A0Two%20thirds%C2%A0of%20the,ITU

UNESCO. (2020, April 21). *Startling Digital Divides in Distance Learning Emerge*. Www.unesco.org. https://www.unesco.org/en/articles/startling-digital-divides-distance-learning-emerge

UNESCO. (2021a, March 19). *One year into COVID-19 education disruption: Where do we stand? | UNESCO*. Www.unesco.org. https://www.unesco.org/en/articles/one-year-covid-19-education-disruption-where-do-we-stand

UNESCO. (2021b, March 19). *One year into COVID-19 education disruption: Where do we stand? | UNESCO*. Www.unesco.org. https://www.unesco.org/en/articles/one-year-covid-19-education-disruption-where-do-we-stand

UNESCO Strategic Objectives. (2023). Unesco.org. https://www.unesco.org/en/strategic-objectives

Youth-Centered Programs Help to Bridge the Digital Divide in Underserved Communities - IDRA. (2024, August 29). IDRA. https://www.idra.org/resource-center/youth-centered-programs-help-to-bridge-the-digital-divide-in-underserved-communities