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RESILIENCE ACROSS THE EDUCATION ECOSYSTEM DURING THE COVID-19 PANDEMIC

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RESILIENCE ACROSS THE EDUCATION ECOSYSTEM DURING THE COVID-19 PANDEMIC

ABSTRACT

In response to the education crisis during restrictions of COVID-19 pandemic, continuation of education was carried out through broadcasting and digital technologies. However, the majority of children around the world are seen to not have access to such technology. For those who have access to technology and devices, education delivery has not been effective due to lack of digital skills in educators and learners. For those with internet access and digital skills, challenges of online exploitation, violence, and exposure to harmful content is felt. In such a scenario, in order to achieve Sustainable Development Goal SDG 4, adoption of holistic e-resilience by design is needed to help ensure that education is inclusive and fit for the future. But in order to succeed, all stakeholder involvement from the entire ecosystem is essential. This paper has examined critical aspects across the educational ecosystem, highlighted gaps in essential components, and posed alternative approaches and policy reforms.

Multiple dimensions necessary for e-resilient education system have been considered while making the recommendations. National policies and multilateral collaborative approaches are needed to bridge the digital divide and help ensure broadband connectivity for digital education of all students. It is also important to overcome any linguistic barrier. Encouraging technologies to develop educational contents in local language can ensure that language digital divide is bridged. Another important aspect of resilient education system is putting efforts in improving digital skills of educators and learners. Digital literacy programs must be implemented effectively in order to achieve a digitally competent population. The next pertinent aspect is measurement of learning outcomes of students. Different approaches are needed to measure and ensure that meaningful learning is taking place in digital space. It is also important to consider that the content of learning is relevant to the student and the economy, as well as that the means of delivery must also accommodate the learning needs of students. A greater emphasis on digital transformation of technical and vocational education and training in alignment to the labor market must be given while developing curriculum for education.

In order to develop a resilient education system, sociocultural norms also need to be considered. Despite the growing number of initiatives, there is still a prevalence of gender digital divide. A holistic way that

focuses on the technologies including girls and education addressing wider issues surrounding involvement of women in tech sector must be considered. An effective online learning space also needs safety considerations. Holistic strategies to ensure safety of children and girls in digital space is imperative. The school closures during COVID-19 pandemic appeared to be stressful to both educators and learners. Therefore, well-being and positive mental health of learners and teachers ought to be prioritized.

The voices of children and youths, particularly the marginalized, need to be included while shaping policies or while designing interventions. Flexible learning strategies to help ensure underprivileged, poor, or students with disabilities must be attained through policy or multistakeholder partnerships. Digital content must be made inclusive and accessible for all. With all the mapping and discussions made above, the paper has assigned an area of priority for e-resilience in education actions and upon that, needful recommendations have been made.

1. SETTING THE STAGE

The COVID-19 pandemic resulted in unprecedented school closures across the globe, affecting more than 90% of learners (nearly 1.6 billion individuals), in more than 190 countries.[1] As multiple waves of infection continue to affect countries, the crisis is far from over—especially for those uncertain of when there will be mass vaccination will be available. The pandemic is undoing years of educational progress and worsening preexisting educational inequalities, even in high-income countries.[2] The United Nations estimates that 23.8 million additional children and youth may drop out or not have access to school this year due to the pandemic's economic impact alone,[3] which, in turn, will have an impact upon their future opportunities for acquiring essential skills and future employment.

In response to this deepening educational crisis, many countries have been innovative in promoting education and training continuity through the use of broadcasting and digital technologies—from radio, television, and mobile phones to online classes via Zoom and other platforms. Over the past two decades, countries have been using broadcasting and digital technologies in education (to varying degrees) to enhance the quality and relevance of teaching and learning and to improve education management and delivery. COVID-19 has accelerated these efforts to digitalize education.

United Nations Children's Fund (UNICEF), however, found that at least a third of the world's children do not have the technology they need for remote learning via radio, television, and the internet during the pandemic, even in high-income countries.[4] For instance, in California, the fifth-largest economy in the world, only 56% of low-income households have broadband subscriptions.[5] Digital learning solutions are only possible for those with compatible devices and an internet connection. Furthermore, not all connections are strong enough to download data or take part in video calls. In addition, there are challenges related to the lack of digital skills among both educators and learners that prevent participation in online teaching and learning.

For those with internet access and digital skills, there are challenges related to their exposure to harmful content, violence, abuse, and exploitation online. Two out of five children reported having bad experiences using social

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1 United Nations, "Policy Brief: Education during COVID-19 and beyond," Aug. 2020, https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/08/sg_policy_brief_covid-19_and_education_august_2020.pdf.

2 Saavedra, Jaime, "A silent and unequal education crisis. And the seeds for its solution," World Bank Blogs, Jan. 5, 2021, https://blogs.worldbank.org/education/silent-and-unequal-education-crisis-and-seeds-its-solution.

3 United Nations, "Policy Brief: Education during COVID-19 and beyond," Aug. 2020, https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/08/sg_policy_brief_covid-19_and_education_august_2020.pdf.

4 UNICEF, "COVID-19: At least a third of the world's schoolchildren unable to access remote learning during school closures, new report says," press release, August 26, 2020, https://www.unicef.org/press-releases/covid-19-least-third-worlds-schoolchildren-unable-access-remote-learning-during.

5 Lee, Courtney, Justin Goss, and Niu Gao, "How California's Digital Divide Affects Students," Public Policy Institute of California (blog), Apr. 25, 2019, https://www.ppic.org/blog/how-californias-digital-divide-affects-students/.

media that they would not want to tell anyone about.[6] Comprehensive measures to equip both adults and children with the knowledge, tools, and skills to address online risks are necessary.

Trends show that crises and shocks like the COVID-19 pandemic—extreme climate events, increasing trade tensions, and complex geopolitics—will continue to disrupt our lives, which is why resilience building is more crucial than ever. Another clear trend is the centrality of digital technologies as we become more dependent on them to cope, recover, adapt, and transform in this new reality. In education, there has been an urgency to improve teaching and learning systems and to strengthen their resilience through digital transformation.

However, if countries address new crises only as they arise, we will continue to have similarly disjointed responses and again face similar disruptions, undermining development gains and our capacity to protect and enhance quality of life. The hasty adoption of digital solutions for education is likely to not only widen educational gaps and inequalities but also create ripple effects beyond education, with implications on children's nutrition, mental and physical health, and future employability.

As countries move towards "building forward better" from the COVID-19 pandemic, the underlying educational crisis that countries were dealing with even before COVID-19 must be addressed. Pre-COVID-19, the World Bank estimated that 53% of 10-year-old children in low- and middle-income countries could not read and understand a short paragraph, a figure that rose to over 80% in the poorest countries. There were 258 million students out of school, including 59 million children of primary-school age. The situation was worse in communities afflicted by conflict and violence; in particular, girls and children with special educational needs were being left behind.[7]

Therefore, the adoption of holistic e-resilience by design, not by crisis, is essential in education for achieving United Nations Sustainable Development Goal 4, which ensures inclusive and equitable quality education and promotes lifelong learning opportunities for all. Holistic e-resilience will be critical for ensuring that education is equitable, inclusive, and fit for the future.

To help ensure the success of such an approach, however, it is essential to engage stakeholders from the entire ecosystem. This requires stakeholders beyond the education sector: government, civil society, and the private sector working in, for example, telecommunications; physical and mental health; labor and employment; skills development and training; social protection; and finance and planning.

This will, in turn, strengthen communities and countries against future shocks and crises and create opportunities to fully reap the primary benefit of digital technologies: improving lives.

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[6] UNICEF, *Our Lives Online: Use of social media by children and adolescents in East Asia,* Bangkok: UNICEF East Asia and the Pacific Regional Office, 2020, https://www.unicef.org/indonesia/media/3106/file/Our-Lives-Online.pdf.

[7] Hawkins, Robert, Michael Trucano, Alex Twinomugisha, Cristóbal Cobo, and Iñaki Sánchez Ciarrusta, *Reimagining Human Connections: Technology and Innovation in Education at the World Bank,* Washington, DC: World Bank Group, 2020, http://documents1.worldbank.org/curated/en/829491606860379513/pdf/Reimagining-Human-Connections-Technology-and-Innovation-in-Education-at-the-World-Bank.pdf.

This paper holistically examines critical aspects across the education ecosystem, highlighting gaps in essential components that are preventing the realization of resilient, inclusive education systems. In addition, it will also pose alternative approaches, considerations, and policy reforms.

2. The Digital Divide: Digital Infrastructure, Connectivity, and Access

More than half of the world's population continues to have no or low bandwidth internet access, and at least 30% of the global student population lacks the technology at home to participate in digital and broadcast learning.[8] There are stark differences in capacity between and within countries. The share of students with no internet access at home varies from less than 15% in Western Europe and North America to as high as 80% in sub-Saharan Africa.[9] The percentages of students who lack access to a computer for schoolwork range from 25% in China to 40% in Brazil to 65% in Indonesia.[10]

As some schools reopen, remote learning is likely to continue to play an important role in the form of a blended approach.[11] A resilient digital infrastructure is necessary to support the continued functioning of the economy and society during adverse events like COVID-19. However, the cost of deploying and maintaining the resilience of hardware and software is a huge barrier for many parts of the world.

Within nearly all countries, there is a rural-urban divide that must be addressed. Globally, three out of four students unable to be reached by countries' remote learning policies during the COVID-19 pandemic come from rural areas and/or belong to the poorest households.[12] Moreover, many rural and remote regions do not have the basic infrastructure to support the use of digital technologies due to irregular supply of electricity, specifically in terms of stable and strong broadband.

Support in mapping access for broadband internet in schools, households, and compatible devices for remote learning is needed, which will guide e-resilience in education strategies that focus on reaching the students furthest behind. The mapping will occur first, informing the development of targeted interventions and the appropriate mix of technology for delivering education.

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[8] UNICEF, "COVID-19: Are children able to continue learning during school closures?" Aug. 2020, https://data.unicef.org/resources/remote-learning-reachability-factsheet/.

[9] UNESCO, UNICEF and World Bank, "What have we learnt? Overview of findings from a survey of ministries of education on national responses to COVID-19," Paris, New York, Washington, DC: UNESCO, UNICEF, World Bank, Oct. 2020, https://openknowledge.worldbank.org/handle/10986/34700.

[10] OECD, "Learning remotely when schools close: How well are students and schools prepared? Insights from PISA," Apr. 3, 2020, https://www.oecd.org/coronavirus/policy-responses/learning-remotely-when-schools-close-how-well-are-students-and-schools-prepared-insights-from-pisa-3bfda1f7/#figure-d1e74.

[11] UNESCO, UNICEF, and World Bank, "What have we learnt?" Oct. 2020.

[12] UNICEF, "COVID-19: Are children able to continue learning during school closures?" Aug. 2020.

Governments need to develop and implement national broadband policies with specific actions to target excluded populations, including commitment of funds (e.g., through the use of universal access and service funds[13]) to invest in initiatives that reduce inequalities in information and communications technology (ICT) access, including subsidizing data and devices. When investments are made in providing digital hardware and software to schools and households, there is also a need to target the provision of assistive technologies based on learners' specific needs.

Public–private sector partnerships should be formed between governments and companies—specifically, telecommunications providers and device manufacturers—to speed up the delivery of affordable access and secure reliable connectivity to marginalized populations

3. Language Digital Divide

There is a language divide in which approximately half of content online is in English,[14] including many of the massive open online courses (MOOCs) and open educational resources. Gaps exist in investments in the development of content adapted to local contexts and languages, particularly to support learning and literacy in minority and Indigenous languages and promote learning in children's first language. Addressing the language divide is crucial yet complex for many countries given rising migration rates—including forced migration[15]—requiring many of them to address the education of children and youth from different countries with diverse language needs.

Educational reforms must consider the growing evidence that marginalized children whose primary language is not the language of instruction in school are more likely to drop out or fail in early grades. For children who do succeed through a language transition program, there is the risk that they will lose the ability to connect with their cultural heritage. Research suggests that engaging marginalized children in school through mother-tongue-based multilingual education is a successful model for achieving equal education for all.[16]

The use of digital technologies to provide content translated into multiple languages, or videos that feature native-language audio and/or subtitles, can help overcome some of the language barriers in cost-effective ways,

[13] Universal service and access funds are managed by governments and dedicated to expanding the ICT infrastructure to unserved and underserved communities. These funds are typically financed through mandatory contributions by ICT network operators and service providers.

[14] Matsakis, Louise, "Bridging the Internet's Digital Language Divide," *Wired*, Jun. 13, 2019, https://www.wired.com/story/internet-digital-language-divide/.

[15] IOM, *World Migration Report 2020*, Geneva: International Organization for Migration, 2019, https://publications.iom.int/system/files/pdf/wmr_2020.pdf.

[16] Ball, Jessica, "Children Learn Better in their Mother Tongue," Global Partnership for Education, Feb. 21, 2014, https://www.globalpartnership.org/blog/children-learn-better-their-mother-tongue.

especially when developed as open educational resources.

Research, however, indicates that digital content and solutions are often created in developed countries and are "handed down" to developing countries. In these cases, their appropriateness to local contexts and countries' readiness to adopt these solutions must be carefully assessed.[17]

4. Lack of Skills for Digital Teaching and Learning

Studies show strong evidence suggesting that large-scale distribution of technology is not a guarantee of educational continuity and positive outcomes. Key dependencies for successful educational outcomes are alignment with the curriculum and teaching quality.[18]

Over 60% of adults lacked basic digital knowledge and skills when schools across the world suddenly closed to curb the spread of COVID-19, forcing a rapid leap to remote learning.[19] From the onset of the pandemic, educators were immediately tasked with implementing remote learning modalities, often without sufficient guidance, training, or resources.

School closures affected around 63 million primary and secondary teachers.[20] They have been, and remain, on the frontlines of the response to ensure that learning continues. Educators have had to rapidly innovate their approaches to teaching in order to facilitate quality remote learning for students. They have also played a key role in communicating measures that prevent the spread of the virus, ensuring that children are safe and supported.[21]

Yet, one of the main hurdles in e-resilience in education is the lack of educators with both the technical and pedagogical skills for digital teaching. Educators need to be supported in the delivery of education using various digital platforms and applications. This is not just about teaching them digital skills, but rather ensuring that they can use a diversity of technologies to support learners in their varying needs.

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[17] Lim, Cher Ping, and Victoria L. Tinio, "Digital Learning for Development in Asia: Final Technical Report (Revised)," Foundation for Information Technology Education and Development, 2018, https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/57720/57625.pdf.

[18] McAleavy, Tony, Chris Joynes, Emma Gibbs, and Kate Sims, "Overview of emerging country-level response to providing continuity under COVID-19: What steps are being taken to reach the most disadvantaged students during the period of COVID-19 school closure?" Report, Education Development Trust, May 2020, https://edtechhub.org/wp-content/uploads/2020/09/disadvantaged-students.pdf.

[19] OECD, "Highlights," *OECD Employment Outlook 2019 The Future of Work*, Paris: OECD Publishing, 2019, https://www.oecd.org/employment/Employment-Outlook-2019-Highlight-EN.pdf.

[20] UNESCO, "Supporting teachers and education personnel during times of crisis," UNESCO COVID-19 Education Response, Issue Note, no. 2.2, April 2020, https://unesdoc.unesco.org/ark:/48223/pf0000373338.

[21] UNESCO, UNICEF and World Bank, "What have we learnt?" Oct. 2020.

Challenges educators face include managing a large workload, coping with increased family responsibilities, and having confidence in their use of new digital tools and the quality of digital learning materials. In many contexts, teacher professional development has moved online or has been disseminated via phone and video applications, but marginalized teachers may have missed out on such support.

Guidance for developing national digital literacy frameworks for educators and learners and their incorporation into national educational plans and budgets is needed. This should include support for developing programs for training preservice and in-service teachers to develop digital learning content and effectively manage remote classrooms with a range of digital platforms and tools as well as deliver education in emergencies/crises.

Governments in collaboration with the private sector and civil society must integrate digital literacy skills in formal and nonformal education and provide training to educators in delivering digital literacy skills courses. They must also ensure that digital literacy programs include: out-of-school children; youth not in education, employment, or training (NEET); women and girls; persons with disabilities; people living in rural areas; ethnic minorities; and other marginalized groups.

Automation and robotics can displace workers who do not have digital literacy skills and are, therefore, unable to transfer their skills to new positions. Worldwide, it is estimated that automation in the workplace will cause 1.2 billion workers to lose their jobs.[22]

5. Measuring the Quality of Learning for All

During emergencies, emphasis is typically on educational continuity rather than quality. A gap exists in monitoring and quality assurance mechanisms that give voice to poor and marginalized children and their families.[23] Data is rarely disaggregated, which prevents policymakers from understanding the level of student engagement by different dimensions of marginalization (e.g., gender, income, disability, location, race, and ethnicity), and, as a result, there is a lack of clarity on the roles and responsibilities of teachers, school leaders, government officials, and other stakeholders in ensuring learning continuity and quality for marginalized children.

Clear metrics must be established so that the effectiveness of the provision of education to poor and marginalized learners can be measured. Efforts are needed in the development of approaches to collect data on groups currently absent from or invisible in data sets that are likely to be particularly relevant for national education planning, for example, nomadic people, urban slum populations, street children, children in institutions, ethnic minority

[22] ESCAP, *Inequality in Asia and the Pacific in the era of the 2030 Agenda for Sustainable Development*, Bangkok: United Nations, 2018, https://www.unescap.org/publications/inequality-asia-and-pacific-era-2030-agenda-sustainable-development.

[23] McAleavy, Tony, et al., "Overview of emerging country-level response to providing continuity under COVID-19," Education Development Trust, May 2020.

populations, LGBTQ+ children and adolescents, migrants, refugees, and internally displaced populations. Approaches for more inclusive learning assessments are also needed, enabling the participation of children with different types of disabilities or who might otherwise be excluded if they are not at school.

Additionally, the integration of disaggregated data on risks (e.g., disasters, pandemics, and other crises) and their impacts on education, the digital divide, educators' and learners' health, educators' abilities in pedagogical practices for different forms of teaching (e.g., classroom, remote, hybrid/blended), students' engagement and performance in learning, and parents/guardians' feedback can provide new and holistic insights for education policy and planning.

Digital technologies can offer solutions for collecting and integrating timely, disaggregated data to identify the most marginalized students and monitor their learning, yet few interventions are currently utilizing this potential. The development of national education management information systems can provide quality data facilitating evidence-based education ecosystem policy and planning.

Gaps, however, exist in establishing clear policies relating to data management in education, particularly policies that protect educators, learners, and marginalized groups from harm, ensuring their safety, security, and privacy. Other gaps include the capacity to use disaggregated data for education policy and planning and for guidance on targeted interventions to reach marginalized groups.

A collaborative effort among government, the private sector, and civil society is needed to address data gaps and build ICT capacity to collect, analyze, visualize, and disseminate data in relevant and useful formats for building e-resilience in education.

6. Relevant Skills, Digital Content, and Solutions

Digital technologies have the potential to offer more engaging, relevant content to inspire and motivate learners and educators. Digital technologies can also enhance flexibility in learning and certification. This is important for marginalized learners who may find it difficult to learn within constrained requirements of formal education systems.

Making high-quality and essential digital content available in various formats across diverse platforms and through different technologies for learners and educators—as well as for those supporting children's learning (e.g., parents/guardians, community leaders and volunteers, and school leaders and administration)—will help to ensure e-resilience in education.

However, the educational platforms, tools, and content used for remote learning are not always accessible nor are they relevant to certain demographics. Women and girls, particularly those in low-income families or those with disabilities, are linguistic minorities. Generally, gaps exist in the representation of women and girls, persons with disabilities, and other marginalized groups in the design and production of educational content.

Governments need to incentivize and support local content creation and digital innovation in education by and for poor and marginalized groups. Educators, with their insights into learners' academic and socioemotional needs, should be involved in the development of curriculum-relevant digital educational resources.

Considering that access to electricity and connectivity remains limited in many parts of low- and middle-income countries, it is important to look into low- or no-tech solutions. Solutions should include providing alternative learning methods for those who for whatever reason are unable to access or use digital technologies so that they are not further marginalized.

7. Landscape of the Industry Skills Divide

Another major challenge is related to the rapidly changing labor market and skills requirements. Moving forward post-COVID-19, digital transformations are likely to accelerate. Automation and robotics can displace workers who do not have digital literacy skills and are, therefore, unable to transfer their skills to new positions. Worldwide, it is estimated that automation in the workplace will amount to 1.2 billion workers losing their jobs.[24]

Skills and wage gaps are widening between those who can adapt to advancing technologies and those who cannot. Without effective policies, the gap between adequately skilled and nonskilled workers will increase income inequality and undermine inclusive growth efforts.

Youth have continued to struggle to align their skills with the labor market. Youth unemployment has been rising since the 2008 financial crisis, and, in early 2020, 21% of youth were NEET globally.[25] With COVID-19, the number of youth NEET is likely to increase, their challenges amplified by the world's digital leap forward.

Lockdowns have resulted in learning losses, which can affect future academic performance and increase dropout rates.[26] This can make it harder for learners at the secondary and tertiary levels to acquire the necessary skills to pursue further education or vocational training or even secure entry-level jobs. Compared to previous years,

[24] ESCAP, *Inequality in Asia and the Pacific in the Era of the 2030 Agenda for Sustainable Development*, 2018.

[25] ILO, *Global Employment Trends for Youth 2020: Technology and the future of jobs,* Geneva: International Labour Organization, 2020, https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_737648.pdf.

[26] Azavedo, Joao Pedro, Amer Hasan, Koen Geven, Diana Goldemberg, and Syedah Aroob Iqbal, "Learning losses due to COVID19 could add up to $10 trillion," World Bank Blogs, Sept. 10 2020, https://blogs.worldbank.org/education/learning-losses-due-covid19-could-add-10-trillion.

there are fewer entry-level jobs available because of automation, but today's entry-level jobs also require many more skills than they did a decade ago.[27]

Educational reforms must include rethinking adult education and developing lifelong learning strategies that are flexible and able to meet the ever-changing needs of economies. This includes supporting transitions between study and work and transitions across jobs as well as upskilling and reskilling throughout workers' careers. Additionally, the skills and competencies framework for e-resilience requires a holistic approach that encompasses foundational literacy, numeracy skills, and job-specific skills as well as socioemotional skills such as critical thinking, problem-solving, and empathy.

Governments need to promote greater coherence and coordination in relevant skills building and employability efforts through the strengthening of adult learning systems in collaboration with education and training institutions, the private sector, and civil society. Programs ensuring that all workers, particularly the most marginalized, have adequate opportunities for upskilling and reskilling throughout their careers are needed.

A greater emphasis on the digital transformation of technical and vocational education and training (TVET) should be strongly considered to address the misalignment of skills with the labor market. Currently, digital TVET initiatives are small-scale pilot projects driven by individual TVET institutions.[28] The most marginalized rarely attend higher education and often have learning preferences best suited to practical training directly linked to workplace practice. As such, they have the most to gain from a reinvigorated and inclusive TVET sector.

8. Multidimensional Complexities of the Gender Digital Divide

Sociocultural norms that restrict the role of women and girls in society hinder their access to and use of digital technologies; worldwide, women are 20% less likely than men to use mobile internet.[29] Inside households, girls disproportionally bear the burden of household chores and may be limited by gendered norms and attitudes. Outside of households, girls tend to have limited access to community internet and media facilities due to concerns for their safety.

[27] World Economic Forum, *Global Risks Report 2021*, 16th ed. Cologny/Geneva: World Economic Forum, 2021, http://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2021.pdf.

[28] Unwin, Tim, Azra Naseem, Alicja Pawluczuk, Mohamed Shareef, Paul Spiesberger, Paul West, and Christopher Yoo, "Guidance Note 11: Using digital technologies of learning and training for employment," from the Report: *Education for the most marginalised post-COVID-19: Guidance for governments on the use of digital technologies in education*, UNESCO, Nov. 2020, https://edtechhub.org/wp-content/uploads/2020/09/Education-for-the-most-marginalised-Report-Guidance-note-11-v8.pdf.

[29] GSMA, "The State of Mobile Internet Connectivity 2020," GSM Association, 2020, https://www.gsma.com/r/somic/.

Despite the growing number of initiatives to address the gender digital divide, they have not yet made significant changes to gender inequalities, largely because of deep sociocultural norms.[30] To bring about change, a holistic approach is needed that ensures digital skills are taught throughout the education system in a gender-sensitive way; focuses on ways digital technologies can serve to include rather than exclude girls and women in education; and addresses the wider issues surrounding the involvement of women in the tech sector.

Educational content needs to be gender sensitive, promote female role models, and avoid the use of gender stereotypes. The presence of female teachers in schools has been linked to higher enrollment, retention, and learning of girls.[31] As new educational content and resources are generated for both the internet and mass media, investors and creators must consider ways to ensure that girls and women, as well as other marginalized groups, are well represented among the creators and presenters of educational content.

Currently, less than 20% of girls in tertiary institutions globally pursue science, technology, engineering, and mathematics (STEM) fields of study, compared to 35% of boys.[32] Girls' relatively lower enrollment and graduation rates in STEM disciplines, which would allow them to thrive in a digital world and contribute to a more inclusive design of digital content and solutions, perpetuate a cycle of widening gaps and greater inequalities. The rural-urban divide impacts exposure to STEM learning, which may be more available in well-resourced urban schools.

Gaps also exist in efforts toward involving educators, learners, parents/guardians, and communities in programs or campaigns that help them to reflect critically on their attitudes and values towards gender equality and the importance of education for all. Interventions that raise parents'/guardians' awareness of the remote learning resources that are available and the benefits arising from girls' access to education technology can increase girls' access to remote learning opportunities.[33]

Additionally, there is a lack of access to safe spaces for girls (virtual and/or physical) where they can interact and learn together. There is strong evidence that group learning and learning outside of the classroom (e.g., in girls' clubs) have a positive impact on girls' empowerment and help girls develop greater aspirations and commitment

[30] UNESCO, "Guidance Note 3: Digital technologies and girls' education," from the Report: *Education for the most marginalised post-COVID-19: Guidance for governments on the use of digital technologies in education*, UNESCO, Nov. 2020, https://edtechhub.org/wp-content/uploads/2020/09/Education-for-the-most-marginalised-Report-Guidance-note-3-v8.pdf.

[31] Allier-Gagneur, Zoe, and Caitlin Moss Coflan, "Your Questions Answered: Using Technology to Support Gender Equity, Social Inclusion and Out-Of-School Learning," EdTech Hub, Jun. 14, 2020, https://docs.edtechhub.org/lib/VX7UW757/download/G2HUI699/Allier-Gagneur%20and%20Moss%20Coflan%20-%202020%20-%20Using%20technology%20to%20support%20gender%20equity%2C%20social%20.pdf.

[32] UNICEF and ITU, *Towards an equal future: Reimagining girls' education through STEM,* New York: UNICEF, 2020, https://www.unicef.org/reports/reimagining-girls-education-through-stem-2020.

[33] Naylor, Ruth, and Kristine Gorgen, "Overview of emerging country-level response to providing educational continuity under COVID-19: What are the lessons learned from supporting education for marginalized girls that could be relevant for EdTech responses to COVID-19 in lower- and middle-income countries?" Report, Education Development Trust, https://edtechhub.org/wp-content/uploads/2020/05/marginalised-girls.pdf.

to academics.[34] Providing opportunities for girls to learn and discuss their challenges together in a safe space is likely to support their academic learning. These safe spaces can also be used to provide broader social support for girls.

To support women and other marginalized groups, concerted actions among government, the private sector, and civil society are needed to create relevant digital content, applications, and services in local languages; enhance digital literacy and skills development and STEM learning and career opportunities; and address the sociocultural barriers these groups face in accessing and using digital technologies.

9. Lack of Basic Safety and Protection of Children–Online and Off-line

School closures expose children to risks, and serious gaps exist in the resiliency of education systems to respond to these risks. For instance, school closures increase household stress as it affects the ability of many parents/guardians to work, which can lead to increasing risk of violence against children. Gender-based violence has increased in both advanced and developing countries, online and off-line, during the COVID-19 pandemic, which in turn prevents access to learning.

Evidence suggests that there has been an increased risk (of x, y, x) of children forced into child marriages as well as increasing cases of female genital mutilation and cutting (which are often linked with child marriage) since the start of the pandemic. World Vision estimates that an additional four million girls will be forced into marriage in the next two years due to the COVID-19 school closures.

Teenage pregnancies have also increased, and previous health crises suggest that some of these girls may be prevented from returning to school, exposing girls to a greater chance of underage marriage. Child marriage and transactional sex may be adopted in attempts to deal with economic shocks caused by emergencies.

Even as schools reopen, there is the risk that children and young people from marginalized populations will be excluded from reenrollment or opt out of attending school because they need to work or have married and/or have become pregnant. Others will struggle to reengage with schooling as they deal with the long-term effects of violence, abuse, neglect, and exploitation.

Globally, COVID-19 and its “shadow pandemic” on young women and girls risk reversing 25 years’ worth of global

[34] Naylor, Ruth, and Kristine Gorgen, “Overview of emerging country-level response to providing educational continuity under COVID-19,” Education Development Trust.

gains in girls' education and empowerment. There is a clear need for sexual and reproductive health and rights education. But while there is a limited body of evidence indicating that such programs can reduce the risk of early pregnancy, there is strong evidence of the protective effect of formal academic education.

In situations of armed conflict, the absence of school has deprived children and youth of the incentives that help them avoid enlisting in the armed forces. This creates a heightened risk of the recruitment and use of children and youth by armed forces and armed groups, which disproportionately target boys.

In the context of school closures during emergencies, governments need to consider how the protective functions of schools can be achieved through alternative services. A holistic strategy is needed to ensure the safety and protection of children as part of building e-resilience in education, encompassing interventions that address economic shocks via social protection measures, protect children from violence and harm, and ensure that they are able to fully participate in education and continue learning.

Solutions should include harnessing digital technologies to, for example, improve social protection disbursement to marginalized groups through mobile payments and enable girls and women to report abuse and seek support through mobile applications. However, these solutions require careful assessment to ensure they safeguard the security, privacy, and rights of marginalized groups and do not lead to exclusion.

Through increased moves to remote and online education, technology has opened up new spaces in which children and youth are threatened, intimidated, and harassed. Those who have experienced online violence may be reluctant to participate in online classes, undermining the achievement of inclusive and equitable education. Violence against LGBTQ+ students and other learners with nonbinary gender identities is also increasing, unfairly affecting their access to education.

Furthermore, prolonged lockdown, school closures, loneliness and diminished job opportunities can make children and youth at higher risk of exploitation online by organized crime and recruitment by extremist groups, especially on social media sites and gaming platforms. A coalition of actors—including educators and parents/guardians, child protection agencies, law enforcement agencies, social media, gaming platforms, software/application developers and distributors—must be actively engaged (with strengthened capacity) to address these issues,

More broadly, megatrends such as increased migration and globalization are affecting education, and the education system needs to evolve to ensure its relevance by addressing in the curriculum these sensitive topics related to identity, diversity, inclusion, and integration into society as well as the importance of digital

citizenship. Digital citizenship is often referred to as the responsible and safe use of digital technologies to engage with others online in a respectful and tolerant manner.

Officials, administrators, educators, and parents/guardians must be supported to respond effectively to the increasingly diverse needs of learners and the risks they face and prepare them for the digital world. This includes building their capacity to identify and report violence, radicalization, and other forms of harm against children and youth, both online and off-line, and support those encountering it.

10. Physical and Mental Well-Being of Educators and Learners

As evident in the previous sections, schools are hubs for social services beyond academic learning, many of which encourage the enrollment and retention of children and youth who might otherwise be excluded from education.

At the peak of school closures, an estimated 396 million children and youth worldwide lacked access to school-based nutrition and nutritional supplement programs, which both combat malnutrition and incentivize parents/guardians to enroll their children in school, especially girls.

School closures also meant children and youth lost important informal social amenities and safeguards, many of which are difficult to quantify yet are crucial to ensuring children's and youth's well-being and healthy development. Relationships with their peers and teachers can promote positive mental health, and the schools provide entry points into social networks for both learners and their parents/guardians.

This interrelationship between education and health calls for a more integrated systems approach and coordinated action. Governments need to ensure that learning environments are secure, safe, and promote the health and psychosocial well-being of learners, teachers, and other education personnel. Furthermore, capacity and engagement with health and child protection personnel must be strengthened to address complex sociocultural issues, such as the impacts of gender-based violence, forced armed recruitment, child labor, migration, and so forth.

11. KEY CONSIDERATIONS

Children and youth as agents of change. Children's and youth's voices and perspectives, particularly those of the poor and marginalized, must be considered when shaping policies and designing interventions. Addressing risks and providing protection is important, but children and youth also need to be empowered as active agents in their own development and education.

When learners are engaged in designing their own learning process, evidence shows that learning outcomes are generally improved. Young people are more interested in their learning if they have invested time and effort in helping to design it, and involving young learners enhances their sense of responsibility. Also, educators can learn from their students, thereby improving their teaching strategies and skills.

Since many poor and marginalized learners have never been to school, it is important that they are also engaged in the design of educational content and digital systems that will be used to educate and support them.

Reaching out-of-school children. The United Nations estimates that 260 million children are out of school because of poverty, conflict, natural disasters, disability, gender inequality, exploitation, and lack of access to clean water and sanitation.

For a variety of reasons, gaps exist in strategies and solutions for addressing the complexity of reaching children who are not in school. Holistic thinking and multistakeholder collaboration within the education ecosystem is necessary to address the complex barriers related to out-of-school children's access to quality education.

Flexible learning strategies adopted by some countries, such as independent study programs or evening programs provided through nonformal education, vocational schools, universities, and open education programs, have helped marginalized groups significantly. Specifically, it has helped young mothers and working mothers receive access to quality education. Some countries have provided financial support and incentives for the education of marginalized groups, particularly in purchasing uniforms, arranging transportation to schools, and implementing food-for-education programs. Nonetheless, underlying sociocultural norms and policies—such as those that prevent pregnant teenagers, persons with disabilities, or refugees from attending mainstream schools—must be addressed. These are discussed further in the following sections.

Children with disabilities and special educational needs: Data on out-of-school children is limited, but, recently, it was estimated that about half of all the primary and secondary school age learners who are out of school anywhere in the world are children with disabilities and special educational needs. Another study shows that

90% of children living with a disability in developing countries are not in school. The exclusion of children with disabilities and special educational needs from school not only impacts upon their learning opportunities but also their nutritional needs and their access to important therapies and related support they can receive at school.

Tools and resources for learners with disabilities and their parents/guardians require enhancing accessibility features, such as audio narration, sign-language video, simplified text, and provision of assistive devices. Teachers, school leaders, and local government officials also need clear guidance and training on how to engage with learners with disabilities. Moreover, wider sociocultural issues related to the stigma and discrimination against persons with disabilities attending mainstream schools must be addressed by changing attitudes, policies, and legislation.

It is important to ensure that digital content and solutions are affordable and available in accessible formats for persons with disabilities. Although accessibility standards and guidelines like those developed by the World Wide Web Consortium (W3C) are being applied to some websites and mobile apps, many remain inaccessible to persons with disabilities.

In survey results from Save the Children, 90% of caregivers of children and youth with disabilities reported encountering obstacles to learning and a World Bank survey noted that education platforms often lack features such as transcripts and closed captioning, screen readers, and print magnifiers. National policies and incentives are required to fast-track effective learning for persons with disabilities through the use of disability-accessible technologies.

Engagement with and support for parents and guardians: Partnership with parents/guardians is important in ensuring the continuity of learning for children and in building e-resilience in education. COVID-19 and school closures have led to parents/guardians playing a greater role in children's learning, bringing to light many marginalized parents'/guardians' lack of capacity to support their children's learning.

The extension of support to parents/guardians, particularly to poor and uprooted families and parents/guardians of children with disabilities, is needed. This ranges from financial support to ensure continuity of learning to guidance and advice on children's learning (e.g., through establishment of help line services) and assistance from various social services (such as accessing food during the current crisis and reporting domestic violence). Digital technologies can contribute to effective delivery of support to parents and guardians.

Essential mental and psychosocial support. COVID has brought the topic of mental health to the fore, and mental

health has risen quickly to the top of the agendas of both policymakers and researchers. Research shows that the mental health of about 80% of children and youth across the globe has deteriorated since the start of COVID-19. Loneliness and anxiety among youth in developed economies have also been described as being an *epidemic*. A rise in alcohol and substance abuse and attempted suicides has also been documented, illustrating the urgency for a variety of psychosocial support systems for children and youth.

Families disconnected from the ability to learn at home are also often those who are generally disconnected from wider systems of health care and social support. This reinforces downward spirals of deprivation. The tendency in many countries for support to be provided in silos means that the root causes of problems are often insufficiently resolved.

Despite increased awareness of mental health, the stigma associated with having mental health issues means that many learners still do not seek needed treatment. Consequently, addressing the problem of making mental health services accessible to learners requires finding ways to deliver services with less stigma, particularly for some groups. Digital technologies may help expand mental health services to those who seek support and may help reach learners who otherwise resist seeking treatment, particularly those already connected to technology.

Although some studies have warned that overuse of technology and social media may put learners at risk for added stress and feelings of social isolation, it is also possible that technology can offer a new access point for learners looking for mental health support. Key to success in this area will be ensuring that technology is applied to both prevention and treatment, as both are necessary to effectively address mental health issues.

Educators also need psychosocial support if they are to meet the needs of their learners. Without support to ensure their physical health, safety, and emotional well-being, the strain can lead to burnout, resulting in high rates of absenteeism, and can even lead some educators to leave their jobs, undermining efforts to build school resilience. Initiatives and networks for educators to remotely support each other, both professionally and psychosocially, through online coaching and mentoring could help.

Generally, increased investment is needed for boosting well-being and mental health support in schools for educators, learners, and parents/guardians. More importantly, a holistic and coordinated approach is needed in the delivery of connectivity, education, health, and social protection services. This will not only enhance cost-effectiveness by allowing costs to be shared more widely across different functions and services but will also enhance the overall effectiveness and efficiency of service delivery.

Children affected by conflict. The United Nations High Commissioner for Refugees (UNHCR) estimates that more

than half the world's school-age refugees are excluded from education and requires that the international community and host governments come together to fund refugee education and improve its quality. Girls are almost 2.5 times more likely to be out of primary school and are 90% more likely to miss secondary schooling than boys if they live in conflict-affected countries.

Children who arrive in countries where their families plan to stay can face barriers to entering public school systems. For some, information is unavailable or language and cultural barriers make it difficult to gain access. Xenophobia, exclusion, and stigmatization can create inhospitable, dangerous environments for children seeking to join a new school system. Moreover, many refugees are barred from school because they do not have education certificates and identity documents or because the host country does not recognize the certification issued from the refugee's country of origin.

UNHCR and UNICEF call for migrants, refugees, and internally displaced children and youth to be included in national education systems instead of being placed in unofficial parallel schools. This will give them the recognized qualifications that can be their springboard to university or TVET. The provision of services such as psychosocial counselling, language instruction, and integration support is essential.

UNHCR and the UNICEF also call for a more realistic approach on the part of schools, universities, and education ministries towards documentation and certification. The use of secure digital systems linked to online identity management offers potential, although there are security and privacy risks associated with such initiatives.

Migrants and refugees. For migrants and refugees, a key challenge is the need to show their credentials in a host country before they can gain formal employment. This requires building a set of globally compatible requirements, standards, and pathways or—at the very least—regional or bilateral agreements between countries.

12. Conclusion

This paper has identified the gaps and opportunities for building resilient education systems that must first address the learning needs of the poorest and the most marginalized. The complex interrelated aspects highlighted in this paper must be taken into consideration for post-COVID-19 planning and recovery in education to ensure that resilience is built into education systems and to ensure that children, youth, educators, and other stakeholders in education have the resilience to better cope with and "bounce forward" from future challenges and crises.

The need to engage with stakeholders across the education ecosystem is critical to ensure e-resilience across the education system. Furthermore, holistic engagement and partnership is vital for the various coalitions, alliances, and collaborations currently addressing the global education crisis as well as for the growing ecosystem of edu-technopreneurs and start-ups that evolved during the COVID-19 pandemic, accelerating the development of local educational content and solutions. This provides a robust practical foundation to recover and build resilient and effective education systems and outcomes for the future.

Areas for priority e-resilience in education actions include the following:

- Support mapping access to and use of broadband internet in schools and households and the ownership of compatible devices for remote learning, which will guide e-resilience in education strategies that focus on reaching the furthest behind first and inform the development of targeted interventions and the appropriate mix of technology for delivering education.

- Promote a holistic and coordinated approach in the delivery of connectivity, education, health, and social protection services. This will not only enhance cost-effectiveness by allowing costs to be shared more widely across different functions and services but will also enhance the overall effectiveness and efficiency of service delivery.

- Promote a holistic and coordinated approach to bridging the gender digital divide that: ensures digital skills are taught throughout the education system in a gender-sensitive way; focuses on ways digital technologies can serve to include rather than exclude girls and women in education; addresses the wider issues surrounding the involvement of women in the tech sector; and tackles sociocultural norms that prevent women's and girl's access to and use of digital technologies.

- Promote a holistic and coordinated approach to track and reach out to marginalized and less visible groups who are likely to drop out of school or are already out of school.

- Provide guidance in developing national digital literacy frameworks for educators and learners and their incorporation in national educational plans and budgets. This should include support for program development to train preservice and in-service teachers to develop digital learning content and manage remote classrooms effectively with a range of digital platforms and tools and also be able to deliver education and social support in emergencies/crises.

- Initiate the digital transformation of TVET to address the misalignment of skills with the labor market, particularly among marginalized groups.

- Enforce standards for the development of digital educational tools and resources for learners with disabilities.

- Develop digital content adapted to local contexts and languages, particularly to support learning and literacy in minority and Indigenous languages and promote learning in children's mother tongue.

- Collect and integrate timely, disaggregated data to identify the most marginalized learners and monitor their learning to help develop evidence-based policy and planning.

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