Building Resilience in Education Systems

Edited by Elizabeth M. King and Daniel Suryadarma

ADBInstitute

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Acknowledgments

Foreword 1

Building resilient systems is challenging because it requires forward-looking planning before shocks occur. Effective plans to foster resilience should include both *ex ante* investments to reduce the negative impacts of shocks as well as *ex post* responses to alleviate harms caused by the shocks. The massive disruptions to education and high mortality costs of the COVID-19 pandemic put a spotlight on the urgent need to build more resilient education and health systems. Helping developing countries to realize this goal is a top priority of the Asian Development Bank and other development organizations.

It is now well-documented that extended school closures led to significant learning losses among children all around the world. At the same time, many positive lessons were learned from the pandemic experience. Educators adopted diverse approaches to support learning when schools were closed and to remediate learning losses when students returned to school. These efforts successfully reduced the extent of learning losses in many countries.

This timely publication includes a set of valuable studies that share experiences and lessons from the recent pandemic experience as well as from how education systems responded to other challenging circumstances, such as conflicts and natural disasters. Climate change is increasing the frequency of natural disasters, which is keeping resilience at the top of the policy agenda. This volume thus provides invaluable insights for policy makers and other stakeholders who are leading efforts to build more resilient education systems.

Albert Park
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Foreword 2

The coronavirus disease (COVID-19) pandemic brought long and widespread education disruptions. School closures averaged 48 weeks in G20 countries and reached 100 weeks in other countries. Mental stress and economic stress compromised students' learning readiness and weakened support systems. Human capital accumulation was considerably foregone in the form of learning losses, leading to increased school dropouts. Without specific efforts to recover learning, the losses will not be recovered, causing lifetime earning loss and lower economic growth rates. Moreover, learning disparity has worsened because students with lower socioeconomic status tended to suffer larger learning losses.

School disruption, however, is not unique to the pandemic and other health crises. It takes place due to other shocks, such as natural disasters and violent conflicts. It has repeatedly occurred, and its frequency is expected to increase as the threats of climate change grow. The experience of the school dropout during the pandemic and this outlook have brought the need for effective policy responses to the fore.

I am delighted to learn that the production of this timely and relevant book is completed. The book compiles serious studies by education experts from around the world. It provides valuable case studies of diverse experiences from different countries in school disruptions during the COVID-19 pandemic, natural disasters, and conflicts. They strongly suggest that there can be no one-size-fits-all response, on the one hand. Readers will see different views on, for example, the use of digital or computer-aided education technologies. On the other hand, the diverse experiences help us understand what contributes to the resilience of education systems and what kind of resilience should be sought.

I sincerely hope that this book will be read and used widely as a guide for future education policies at national and local levels and for future academic research.

Tetsushi Sonobe
Dean and CEO
Asian Development Bank Institute

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Introduction

Elizabeth M. King and Daniel Suryadarma

Schools are consistently disrupted by external factors unrelated to education, ranging from natural hazards to conflicts and health crises. These disruptions vary both in duration and impact on learning. Natural hazard events typically cause school closures lasting weeks or months, as seen in Bangladesh where about 5,000 schools were closed because of the May 2022 flood, affecting 1.5 million students (chapter 11 essay by Iqbal and Shahana in this volume). While these closures were relatively brief, their frequency—Bangladesh experienced 41 floods during 2000–2023, affecting an average of 2.8 million people (EM-DAT data)—creates persistent challenges for the education system. In contrast, violent conflicts can create more complex, long-term disruptions. During the Second Intifada between 2000 and 2006, Palestinian schools (chapter 6 essay by Di Maio) remained open but operated under conditions that significantly compromised both the quality of the learning environment and students' well-being.

The impact of these disruptions on learning outcomes varies considerably, even when students remain enrolled. Research reveals contrasting patterns of recovery: while some regions show remarkable resilience—as demonstrated in India where students fully recovered from learning losses (Singh, Romero, and Muralidharan 2024)—others face more persistent challenges, such as the lasting effects after the 2005 earthquake in Pakistan (Andrabi, Daniels, and Das 2023). While natural hazard events and conflicts typically affect education systems at a regional level, the coronavirus disease (COVID-19) pandemic presented a far broader global challenge to schooling, with impacts that varied dramatically based on each country's response to this public health crisis. School closures and physical distancing regulations lasted for months in some countries—for example, classes in some states in India were closed for a year. Most countries reopened their schools after February 2022, with 80% returning to business as usual without explicit policies to recover lost learning (World Bank 2023). Without a full recovery, COVID-19 student cohorts in many affected countries

will suffer a lifetime of lower earnings. Simulations indicate that global earnings losses will reach trillions of dollars (ADB 2022), resulting in greater inequality and slower intergenerational economic mobility.

While the pandemic may be behind us, other sources of education vulnerability remain. Climate change will be one of them, increasing the frequency and intensity of events such as floods and heat waves, disrupting learning in the future. Currently, extreme weather events disrupt the education of 40 million students globally every year (Global Partnership for Education 2024). In a recent report, Marin, Schwarz, and Sabarwal (2024) state that since the early 2000s, extreme weather-related school closures have affected at least 5 million students.

As climate change ramps up, longer and more intense disruptions are expected. This will mainly affect low- and middle-income countries, also home to 85% of children globally (Marin, Schwarz, and Sabarwal 2024). The impact will occur through two pathways. First, more financial resources are needed to climate-proof infrastructure and rebuild those destroyed through disasters. Second, disasters negatively affect the economy, reducing a country's ability to pay for higher needs. These two channels will widen the financing gap that many developing countries face (chapter 13 essay by Tammi and Martínez).

Increasing the resilience of education systems in facing these disruptions is a policy imperative. A resilient education system can withstand and adapt to various shocks and disruptions, such as natural disasters, conflicts, health emergencies, and economic crises, while minimizing the impact on teaching and learning processes. The essay by Tan and Chua (chapter 3) states that a resilient education system is characterized by its structures, processes, and people. Kaffenberger (chapter 2) argues that education system resilience requires commitment, continuous measurement, and alignment toward learning. Bashir (chapter 5) writes that adaptive policymaking is important for resilience, a practice that the Republic of Korea exemplified during the pandemic (chapter 4 essay by Hong and Park).

Essays on the Republic of Korea and Singapore highlight how these countries responded quickly and effectively to the pandemic. By having already invested in good teacher quality and technological innovations that supported remote learning, the two countries were better prepared to handle learning disruptions. Having robust preparedness plans for future disruptions is an important lesson from the recent pandemic. The challenge to education systems and their leaders is to anticipate these risks to teaching and learning early, as well as to build evidence-driven approaches to recovery (King et al. 2022).

This volume contains 12 essays related to building education system resilience. The essays are written specifically for policymakers and practitioners. They present different contexts, different sources of school disruptions, and the lessons from those disruptions. The volume features reflections from Asia, Middle East, and Latin America. The challenge of building a resilient education system is greater in countries that frequently experience natural hazard events, conflicts, and health crises, are also less developed, and have lower learning levels. As the essays show, solutions will differ by country, but every country can harness whatever resources are available to meet this challenge.

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PART I
Aspects of Education System Resilience

2

Education System Resilience: Committing, Measuring, and Aligning for Learning

Michelle Kaffenberger

2.1 Introduction

While nearly all children experienced school closures during the coronavirus disease (COVID-19) pandemic, emerging empirical evidence suggests learning losses due to school closures vary tremendously—both within and across countries. Equipping schools and teachers to address learning loss and increased variation in learning levels following a schooling disruption is a critical component of a resilient education system.

This essay first reflects on the variation in learning outcomes and losses following the pandemic-induced school closures, drawing on three new data sources covering 11 countries. The data show mixed results: In some places, learning losses were large; in others, losses were small; and in some contexts, learning levels increased following school closures. In contexts where learning losses were small, learning was often very low prior to the pandemic and there was little room for decline.

Given the variation in learning implications of school closures, there can be no one-size-fits-all response. Instead, to ensure resilience, education systems need the capabilities to quickly diagnose and adapt to their particular circumstances following a schooling disruption. The essay then discusses three principles for learning resilience in the face of disruption or crisis:

1. Committing to ensuring learning for all
2. Measuring learning to inform adaptations to instruction
3. Aligning instruction to meet children where they are

These principles are good practices outside of crisis situations too, and education systems can build capabilities now to be prepared for the next time crisis occurs.

2.2 Learning Implications of School Disruption

We first examine three new data sources, which paint a mixed picture in terms of learning levels and changes following the pandemic-induced school closures.[1]

The first is the International Common Assessment of Numeracy (ICAN), developed by the People's Action for Learning Network (PAL Network). These assessments were conducted in Bangladesh, India, Kenya, Mozambique, Nepal, and Nigeria in 2019, prior to the COVID-19 pandemic, and again in 2022. These assessments used a common tool, measuring numeracy skills, in all countries (translated into local languages).[2]

The results show large variations in learning losses between 2019 and 2022 both across the countries assessed and between different age groups within countries. In the Bangladesh and India districts, learning levels declined by the equivalent of half a year's worth of learning between 2019 and 2022 for both younger (6–9 years) and older (10–13 years) age groups. In the Mozambique district, learning levels of children aged 6–9 similarly declined by 0.6 years' worth of learning, though for children aged 10–13 learning stayed relatively stable. In the Nigeria district, learning levels were similar in 2019 and 2022, indicating no significant losses. In the Kenya district, learning was stable among the younger group and improved somewhat for the older group. And in the Nepal district, learning levels were higher in 2022 for both the younger and older groups.

In all cases, these learning losses (or gains) are small relative to the gap to universal numeracy. In the Kenya district, even with the measured

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[1]   This essay draws heavily on a panel at the Comparative and International Education Society 2023 Conference, which included presentations by Nicolas Buchbinder with the PAL Network, Ursula Schwantner with the Australian Council for Educational Research, and myself with the RISE Programme and was chaired by Ramya Vivekanandan with the Global Partnership for Education.

[2]   In each country, one rural district was selected for ICAN. The results are therefore not intended to be nationally representative, but give an indication of learning levels and changes during this period. (They are representative of the district where the assessments were conducted.) The assessments were conducted through household-based surveys, with household sample sizes ranging from 1,023 (Nepal) to 1,229 (India). Results from these assessments were presented at the Comparative and International Education Society Conference in February 2023 (Buchbinder 2023).

improvements in learning levels, still less than 20% of 10-year-olds in 2022 had achieved foundational numeracy. In Bangladesh, following losses, less than 10% of 10-year-olds had. In none of the surveyed districts did more than 20% of 10-year-olds demonstrate mastery of foundational numeracy in 2022.

The second new data source, the Monitoring Impacts on Learning Outcomes (MILO) study, provides further insight on learning implications of the COVID-19 pandemic. This study was conducted by the UNESCO Institute of Statistics, the Global Education Monitoring Centre within the Australian Council for Educational Research, and the Conference of Ministers of Education of French-speaking States and Governments (CONFEMEN). It studied learning changes in six African countries: Burkina Faso, Burundi, Côte d'Ivoire, Kenya, Senegal, and Zambia.

The study used learning measures calibrated to Sustainable Development Goal 4.1, specifically proficiency in reading and mathematics at the end of primary school (SDG 4.1.1 (b)). It involved linking national or regional assessment results conducted prior to 2020 to a new assessment conducted in 2021 as part of the study. The assessments were set to a common scale, allowing comparisons of proficiency levels prior to school closures and after school closures. These results were also presented at the Comparative and International Education Society Conference in February 2023 (Schwantner 2023).[3]

For math, five out of the six countries showed no significant difference in proficiency levels between the pre-pandemic assessment and the 2021 assessment. The only country that had a significant difference, Burkina Faso, experienced an improvement in proficiency levels. For reading, no statistically significant differences in proficiency levels were detected either.

Looking at disaggregated data, in Kenya, boys experienced learning loss in math, while girls did not. For all other scenarios, there were no statistically significant differences in the learning effects of school closures for girls and boys.

These results, both from the MILO assessments and the mixed results from the ICAN assessments, are rather surprising, as data from many other parts of the world are revealing large learning losses following the pandemic. One possible explanation is that remote learning efforts in these contexts were effective at preventing learning losses. However, in all countries in both the ICAN assessments and the MILO assessments, less than half (and often less than a third) of

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[3]   The results are also available in UNESCO Institute of Statistics (2022).

students experienced remote learning. Another possible explanation, common across the two assessments, is that learning was so low before the pandemic that little decline was possible (especially a statistically significant decline). In the MILO assessments, with the exception of Kenya, less than 20% of children demonstrated proficiency in reading in all countries. In four out of the six countries, 20% of children or fewer demonstrated proficiency in math. In the ICAN assessments, in each country, 20% of children or fewer demonstrated proficiency in math.

Finally, we turn to the third new source of learning data: the ASER assessment in India. ASER has been conducting large-scale learning assessments since 2005. In 2022, it surveyed nearly 700,000 rural children (ASER Centre 2023). The ASER assessment measures children's reading across four levels: whether a child can read letters, words, a simple paragraph (Standard I [grade 1] level skill), or a "story" (Standard II level skill). For math, it similarly uses four levels: measuring whether a child can recognize the numbers 1–9, recognize numbers 11–99, do two-digit subtraction with borrowing, or solve a division problem that involves dividing a three-digit number by a one-digit number.

The 2022 assessment found that children's reading levels had declined to pre-2012 levels, erasing more than 10 years of learning gains prior to the COVID-19 pandemic. Comparing the most recent pre-pandemic assessment results with the 2022 results, the percentage of children in Standard III who can read a Standard II level text dropped from 27.3% in 2018 to 20.5% in 2022. For children in Standard V, the percentage who can read a Standard II level text dropped from 50.5% to 42.8%. Disaggregating the data by state, all states experienced drops in reading proficiency.

In math, the results were more mixed. Across India, the percentage of children in Standard III who could correctly solve a subtraction problem declined from 28.2% in 2018 to 25.9% in 2022. Looking at differences between states, a few states saw improvements, while others saw steep drops of more than 10 percentage points. For children in Standard V, the percentage who could correctly solve a division problem declined slightly overall, from 27.9% to 25.6%, with similar mixed results across states.

These new data, from all three sources, leave us with a mixed picture of children's learning following the pandemic. While some areas experienced large drops in learning outcomes, others held steady (though often at low levels) and yet others experienced small increases. The common thread across these contexts is that regardless of the learning dynamics in recent years, learning levels themselves remain low in all the contexts studied. In many, and for some measures most, contexts,

20% of children or fewer are achieving even minimum proficiency levels, on measures for which SDG 4 calls for universal mastery.

2.3 Principles for Learning Resilience

Such mixed results suggest there is no one-size-fits-all approach for ensuring education systems are resilient for learning in the face of school disruptions. Instead, results like these suggest education systems need to be equipped to quickly diagnose learning levels, losses, and gains, and to adapt instruction and the classroom environment accordingly.

Education systems should invest in building these capabilities now, so that they are in place when the next crisis occurs. Education systems can do so by adopting and adapting components of existing programs that have proven effective in improving foundational learning. For instance, "teaching at the right level" programs involve quickly assessing children's learning levels and adapting instruction accordingly. Structured pedagogy programs support teachers through effective pedagogical techniques and instructional materials to help them meet the learning needs of children in their classrooms. Implementing these types of approaches now will help build capabilities needed in the face of a crisis. These approaches for analyzing and diagnosing learning levels and adapting instruction accordingly can also be valuable and help improve learning outside of a crisis. The evidence suggests that three principles are key for achieving this kind of resilience.[4]

The first principle is that education systems should commit to universal, early foundational learning. Learning for all requires a deep and fundamental commitment to the purpose of learning. Without this commitment, it is difficult or impossible for technical "solutions" to drive change and improve learning (Kaffenberger 2022). In the face of a school disruption or crisis, leaders in the education system should commit to ensuring that all children either continue to learn or can catch up on missed learning when they return to school.

A firm, stated commitment to learning for all, followed by accompanying actions, has played a key role in system transformation in multiple contexts. Viet Nam's status as a high-performing outlier for learning has been attributed to a strong, society-wide commitment to quality education for all (London 2021). Sobral in Brazil achieved large, rapid improvements in learning between 2005 and 2017, which were spurred by the mayor's stated commitment to learning and establishment

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[4]   This section draws on a presentation at the Comparative and International Education Society Conference by Kaffenberger (2023).

of explicit learning goals (Cruz and Loureiro 2020). Tanzania established a commitment to improve reading, writing, and arithmetic in a reform package, enabling a variety of funders and implementers to successfully work toward a common goal (Komba and Shukia 2021; Rodriguez-Segura and Mbiti 2022). A similar commitment in the face of disruptions or crises can enable an education system to rally around a common goal and align efforts toward achieving it.

The second principle is to *measure* learning regularly, reliably, and relevantly (Pritchett, Newman, and Silberstein 2022). As discussed earlier, the learning implications of school closures varied tremendously both across countries and within countries. To achieve learning resilience, education systems must understand the learning levels and trajectories of students. Whether during a crisis or when children return to school following a disruption, education systems need to implement simple, quick-turnaround assessments to shed light on children's learning and inform adaptations to instruction.

Furthermore, education systems do not need to, and should not, wait for a crisis before establishing good practices to measure learning. Even in normal times, education systems should be measuring learning regularly—to track learning across grades and over time, beginning in the early primary grades. This enables identifying the pace of children's learning and identifying individual or groups of children who are falling behind and may need additional support. The RISE Programme has created learning trajectories tools that enable analyzing children's learning dynamics across grades, which have been adopted by the United Nations Educational, Scientific and Cultural Organization (UNESCO), the World Bank, and the PAL Network, among many others.[5]

Different actors in an education system will have different needs in terms of learning measures. For instance, policymakers making high-level strategic decisions need an overview of learning levels and progress across the education system. Regular, sample-based assessments at multiple grade levels may best meet this need. Teachers, meanwhile, need quick, easy-to-use assessments to inform daily instruction in the classroom. These types of assessments can help teachers understand their students' learning levels, track learning progress, and identify gaps and content in need of additional instruction. With good learning measurement practices in place before a crisis, it will be easier to use them during and immediately following a crisis to get learning back on track.

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[5]   See, for instance RISE Programme (n.d.) and UNESCO (n.d.).

Finally, education systems should be aligned around learning commitments and children's learning needs (Hwa, Kaffenberger, and Silberstein 2020; Atuhurra and Kaffenberger 2022). There are two main types of alignment that are needed: One is to align instruction with children's actual learning levels, so that children are not being left behind by the level of instruction. The second is to align instructional components, such as curriculum, assessments, and teaching and learning materials, with each other. As we saw in all three datasets discussed in this essay, only a small proportion of children are reaching grade-level benchmarks in reading and math in each of the assessment contexts. Because children experience disruptions differently, aligning with their learning levels is even more critical following a disruption.

Two of the more successful approaches to improving foundational learning—structured pedagogy and teaching at the right level—have alignment at their core. Structured pedagogy programs provide a highly aligned set of curriculum, textbooks, and teaching and learning materials that are in support of a stated goal. Teaching at the right level, as the name implies, aligns instruction with children's learning levels, ensuring they are not left behind. Both approaches also involve supporting and equipping teachers to implement effective pedagogical techniques. Similar to the measurement principle, effective pedagogy is valuable in normal times in addition to during and after a crisis. Supporting teachers to implement these approaches in the classroom, before a crisis occurs, can equip them with skills to adapt instruction and meet children where they are following a school disruption.

As new data have shown, the effect of the COVID-19 pandemic and related school closures on children's learning has varied tremendously. Rather than an instant solution, this suggests a need for education systems to be equipped to analyze and diagnose learning levels and losses, as well as to enable teachers to adapt instruction accordingly. Resilient education systems are systems that are adaptable and can rise to the challenges that face them. Many of the good practices that will help in a time of crisis are good practices in normal times too, and building capabilities for strong learning outcomes outside of a crisis can complement a system's capabilities for resilient learning during crises. There is an opportunity for education systems to make a deep commitment to learning for all, measure learning in effective ways, and align instruction to meet children where they are—and in doing so, be more resilient in the face of the next crisis.

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3

Structures, Processes, and People: Creating Optimism and Resilience for Future Education Systems

Oon Seng Tan and Jallene Jia En Chua

3.1 Introduction

The coronavirus disease (COVID-19) pandemic shook education systems around the world, testing their resilience in unprecedented ways. Every education system faced their own set of challenges and circumstances, varying in their reactions to the crisis. This essay draws insights from Singapore's pandemic experience to critically evaluate our own education system and to propose a set of characteristics that distinguish resilient education systems. While these are our personalized perspectives drawing heavily from the Singapore experience, we hope they serve as useful input for reflection in other contexts.

Resilience is defined as the capacity to recover quickly from setbacks. A resilient education system is one that is not fundamentally shaken by world changes and can bounce back quickly to ensure that learning is kept alive. The pandemic was a true challenge to the resilience of all education systems. In this essay, we propose that a resilient education system is one that possesses resilient structures, processes, and people with the following characteristics:

1. **Resilient structures** that are adaptive and agile, use scientific and data-driven measures, and harness technology effectively
2. **Resilient processes** that adopt an ecological approach and promote synergy between agents of education
3. **Resilient people** who are developed through values-based education

As the world continues in an era of profound global fragility, it is important to build resilient education systems that can take on unexpected challenges and crises.

3.2 Singapore and Its Education System

First, an understanding of Singapore's context would be useful for readers. Singapore is a city-state with a small land mass and a population of about 5.45 million. It is governed by a central government, which promotes coherent policymaking and implementation. The country's geographical constraints also pose the perpetual challenge of a dearth of natural resources. As such, Singapore has relied heavily on unfettered trade, healthy international relations, and its own human capital to fuel economic growth.

People are Singapore's most important resource. To advance its human capital, education has always been at the forefront of Singapore's priorities. From 2000 until the pandemic, the education sector accounted for roughly 20% or more of the government's expenditure yearly (Macrotrends 2022; UNESCO Institute for Statistics 2022b). This is about 4%–5% more than the world average (UNESCO Institute for Statistics 2022a). Over the decades, Singapore's education, which is consistent with the aims of 21st century education, focused on developing two Cs in students: character and competence. Character refers to a person's values, cultural sphere, and dispositional traits. It encompasses a set of virtues or qualities which shape motivation and guides conduct. For example, virtues such as respect, resilience, compassion, and perseverance, to name a few, are integral components of character and have major implications on civic society. On the other hand, competence refers to a person's learning and thinking mindset and relates more to performance and contribution to society and productivity. Examples include curiosity, critical thinking, and problem-solving.

The Singapore education system's unchanging focus lies in the development of important foundations and alignment with real-world challenges and needs. Thus, the two Cs have taken on different emphasis and significance over time. For example, knowledge-based competence was underscored in Singapore's early post-independence years to ensure economic survival and growth. Currently, a student-centric approach focused on values as well as social and emotional learning is receiving heavier emphasis, especially following the advent of the pandemic.

3.3 Characteristics of Resilient Education Systems

To build a resilient education system, a definition of "resilience" would be useful. Resilience typically takes on two definitions. In the Oxford dictionary, it is defined as the capacity to "withstand" or "recover quickly from difficulties." For this reflection essay, we will adopt the latter definition for the context of education, considering the dynamic reality of the world and the nature of education being a microcosm of the larger world. Essentially, what we teach in education is based on what we think people need in the larger world—and the larger world is constantly shifting. Thus, building a resilient education system is not about building an all-powerful system that is unaffected by change, but about building an education system that is not fundamentally disrupted by world changes by recovering quickly from setbacks.

When the pandemic hit the world in 2020, Singapore's response to the crisis was lauded as prompt, resilient, and flexible. However, it was also confronted with many pressing challenges, such as inequity, mental health concerns, and digital proliferation. The pandemic poses as an apt opportunity for us to critically reflect upon our own national response, as well as the response of our education system.

Overall, Singapore responded in a steadfast manner to manage the public health crisis, by virtue of its coherent policymaking and multi-ministry integration, which allowed for an efficient rollout of measures across sectors. As early as January 2020, a multi-ministry COVID-19 taskforce was established to direct the national whole-of-government response and coordinate government efforts toward the outbreak. The emphasis on data and scientific evidence to shape policies and administrative measures also facilitated Singapore's steadfast response. For example, Singapore was one of the earlier countries in Asia to implement airport screening measures. It also tapped on its existing science and technology infrastructure to develop innovative test kits, manage contact tracing and crowd distribution, and provide community support. Another important success factor was the emphasis on social responsibility. Citizens were prompted to keep others in the community well by instilling a sense of national camaraderie, as well as values of respect, compassion, and social accountability. For example, the public was encouraged to get vaccinated to protect their loved ones and other vulnerable community members.

In education, the above factors contributed to effective measures. First, integrated policymaking allowed for close alignment of school measures with public health measures, through close coordination of the Ministry of Health and the Ministry of Education with the

multi-ministry COVID-19 taskforce. For example, when the Singapore Ministry of Health first raised the Disease Outbreak Response System Condition (DORSCON) level to "orange" (indicating severe disease and high risk of community transmission), the Ministry of Education issued a press release to step up precautionary measures in schools on the same day. During phases of national lockdowns, closure of school premises and the rollout of home-based learning were enacted in tandem. Second, a strong science, data, and technology infrastructure streamlined the adoption of blended learning approaches by tapping into existing learning management systems and e-pedagogy resources. This helped ensure students continued learning effectively throughout the pandemic. Last, opportunities were seized in school to teach and impart social responsibility among children and young people. For example, while wearing masks and washing hands were mandated procedures, they were also used to impart lessons about social responsibility to students. Altogether, learning remained resilient and Singaporean students continued to perform well despite disruptions from the pandemic. On the Progress in International Reading Literacy Study (PIRLS) 2021, Singapore students performed well in both foundational and higher-order reading skills. Singapore improved its reading literacy scores from a mean of 576 in 2016 to a mean of 587 in 2021, making it the only education system where students have made steady progress over the 2 decades since the PIRLS was first enacted in 2001.

Drawing on lessons from the Singapore experience, we believe that education systems must build resilient structures, processes, and people to face times of global fragility and unpredictable conditions. By drawing parallels between Singapore's public health and education response, we discuss each area in the following sections.

3.3.1 Resilient Structures

Resilient structures facilitate learning, challenging, and innovating. They have characteristics that allow us to *learn* from the environment, past mistakes, and other parts of the world; *challenge* standing assumptions, beliefs, and ways of doing; and *innovate* by adopting novel ways of thinking and doing. We believe that an education system can learn, challenge, and innovate when it is adaptive and agile, uses scientific and data-driven measures to inform and drive change, and harnesses technology in a healthy and effective manner. In our digital environment today, scalable technologies are certainly a key priority for building up education system resilience and reaping economies of scale in the long term.

Agility and Adaptivity

The terms agility and adaptivity are often used interchangeably, but they are not the same. They both refer to responding and dealing with uncertainty and changes in the environment, but they do so in different manners. *Agility* relates more to the speed of response within given structures by varying practices and methods to deal with change (Beck et al. 2001). On the other hand, *adaptivity* relates more to system-level changes to deal with complex issues and major disruptive changes, such as community relocations induced by climate change (Bronen and Chapin 2013) and, of course, the COVID-19 pandemic. Thus, adaptivity refers more to a longer-term, systemic change and response. The pandemic reinforced the need for both agility and adaptivity, with countries being tested for their efficiency and timing of policy measures, level of decision centralization, and balance between change and stability. In Singapore, agility and adaptivity could be seen in how resource planning models were calibrated to rapidly adapt to the evolving COVID-19 situation, allowing for the efficient deployment of human and capital resources to sustain health services delivery during infection surges (Lam et al. 2022).

Singapore's education system was also tested for its agility and adaptivity, and it strove to achieve both. First, the Singapore education system was agile in shifting from physical to online learning within 1–2 days after lockdown measures were implemented, ensuring minimal loss of learning for students. This was done by learning from its previous experience of the severe acute respiratory syndrome (SARS) pandemic in 2003, which also led to school closures and the use of e-learning. Since SARS, schools continued to schedule e-learning weeks and activities as a routine for teachers and students to reacquaint themselves with educational technology and remain prepared in the event virtual learning is needed. In line with advancements in technology, Singapore further innovated with educational technology and launched the online learning management system Student Learning Space (SLS) in 2018, which provides equal access to quality curriculum-aligned online resources for all students. As a result, students and teachers tapped the SLS during lockdown to facilitate the swift shift to home-based learning overnight.

Nonetheless, school closures during the COVID-19 pandemic were much longer (1 month) compared to during SARS (1 week). Further phases of lockdowns in the succeeding years after initial waves of the crisis also necessitated more use of technology for learning. This required the system to be adaptive, adopting longer-term changes to teaching and learning practices that utilize technology and blended learning approaches. For example, the Academy of Singapore Teachers

ramped up professional development sessions on the SLS during lockdown phases, to support teachers through the new challenge of intense use of the platform. Even as physical lessons resumed, teachers continued to innovate and incorporate educational technology into lessons, such as using gamification and augmented reality to enhance the learning process for students (Lim 2021) and using mobile apps to improve communication proficiency in Mandarin (O'Brien et al. 2021).

Scientific and Data-Driven Measures to Meet Challenges

In being agile and adaptive, it is also crucial to be sensible when enacting responses. Another key insight from the pandemic is the importance of a steady and measured approach with a balance between inaction and high reactivity. Either ends of the spectrum can be perilous. Nonintervention runs the risk of severe negative effects for society, such as the non-containment of virus spread and complete breakdown of health-care systems. On the other hand, it may be foolhardy to respond to a crisis before all the facts are in. A Singapore example would be how many citizens rushed to supermarkets to hoard daily essentials such as toilet paper and canned food upon first news of the virus outbreak, resulting in severe stock shortage. Calculated inaction, defined as the deliberate decision to not act immediately (McConnel and 't Hart 2019), can often be a better step to understand what is being dealt with before formulating a comprehensive response. Data and scientific evidence can support effective decision-making. With data in hand, decision-makers can use them to pinpoint problems (*learn*) and assess the merits of possible solutions before making informed decisions and creating impact (*challenge* and *innovate*) (Custer et al. 2018). During the pandemic, Singapore used data and scientific evidence regarding COVID-19 to inform policies. As we learned more about how the virus spread and its asymptomatic presentation, past measures were challenged and all this evidence informed Singapore's deliberate rollout of other measures such as deep public cleaning campaigns, stringent isolation measures, and aggressive testing.

A similar approach was observed in education, with data-driven insights being used to inform school measures. For example, data helped the education ministry make informed decisions for when and how to return to in-person instruction. The first round of school closures and home-based learning in Singapore lasted only about 1 month from 8 April to 5 May 2020, comparably shorter than in many other countries. Schools reopened in phases, where graduating cohorts were first prioritized in the return to school premises, followed by other cohorts. Schools also reopened with safe distancing measures in place, such as staggered arrival, recess, and dismissal timings; spaced seating arrangements;

and required wearing of face shields and masks. These measures were informed by data about virus hot spots and household concerns about home-based learning. Although data showed that schools were not hot spots for virus spread at that moment, families were concerned about the difficulty of prolonged home-based learning such as juggling home and work commitments and the reduced effectiveness of learning via a screen (Diman 2020). These concerns were thus balanced by reopening schools with precautions in place to protect both the health and safety as well as learning of students. This approach was also *learned* from other countries, such as the United Kingdom, which also planned to gradually reopen schools to students.

Another example was how research studies on the mental health of students during the pandemic provided data for rising levels of stress and anxiety, prompting a change in the cancellation of school exams during the pandemic. As a country that prides itself on its strong academic performance (e.g., at international benchmark standards such as the Organisation for Economic Co-operation and Development's Programme for International Student Assessment), this was a challenge to the standing assumption that our rigorous testing and examination structure was one of the key drivers of academic excellence. Nonetheless, they were implemented based on evidence of rising stress levels among students and concerns about their welfare. Subsequently, Singapore *learned* from this experience where the positive effects of examination removal were noted. While they were originally short-term examination waivers during the pandemic, they became a long-term reform to examination structures in the system where examination frequency was further thinned out. Other measures aimed at protecting the mental health of students were also introduced, such as explicitly featuring mental health education in the refreshed Character and Citizenship Education curriculum.

Overall, this represents a larger adoption of data-driven reform in both Singapore's education system and the world. Recent major shifts in Singapore's education system, such as full subject-based banding and a new scoring system for the Primary School Leaving Examination, were also *learned* from data and evidence from research and international reviews of other education systems as well as from local pilot research in a number of schools in Singapore. In line with international education trends of having a holistic, strengths-based education as well as flexible pathways to success (*learn*), Singapore reassessed its system's methods (*challenge*) and introduced new changes that align better with these trends (*innovate*). Globally, there is tremendous value for using data-driven insights to solve education's pertinent problems, such as using data to align resources with needs to alleviate inequity issues.

Harnessing Technology in Education

Technology ties in very closely with data, as it is often the vehicle for generating and presenting data. It is a powerful tool growing in ability and permeability and is almost inseparable from our lives. In resilient structures, technology is often harnessed effectively to streamline processes and operations and to boost efficiency. During the pandemic, Singapore tapped on its matured science and technology infrastructure to develop local innovative test kits (A*STAR 2020), implement nationwide digital systems for contact tracing and ringfencing virus clusters (e.g., SafeEntry, TraceTogether), and support the reopening of businesses (e.g., GoBusiness COVID portal).

Harnessing technology effectively in education has the potential to increase engagement and collaboration, as well as accommodate multiple learning styles. For this to happen, there first needs to be appropriate access to technology. During home-based learning in Singapore, schools took advantage of the access to the Student Learning Space, which was originally launched in 2018 but not adopted extensively by schools. However, access to the portal and system was always available to all teachers and students. Paired with agility, teachers and students were able to quickly leverage the system to ensure continued learning during the shift to home-based learning. Another example was how access to digital resources was quickly afforded to disadvantaged populations who did not have sufficient devices to access learning during home-based learning. The Ministry of Education distributed 12,500 laptops or tablets and 1,200 internet-enabling devices to these students (Ang 2020). The nationwide distribution of personal learning devices was subsequently accelerated by 7 years, to support accessibility among disadvantaged students and to minimize the digital gap.

However, there are issues to be wary about when harnessing technology in education, such as how to keep students engaged and safe while using technology. Student engagement in the online learning environment can be suboptimal (Kahn et al. 2017), because of various factors such as a lack of direct contact besides verbal means leading to dissociation. Combs (2020) highlights the importance of diverse learning methods for online learning, to promote students' creativity and interest. During home-based learning in Singapore, there were concerns about its effectiveness, prompting some educators to adopt creative e-pedagogy methods to make learning more collaborative and fun. However, it remains a perennial challenge for all teachers and learners. There were also concerns about security due to hijacking incidents of Zoom lessons, which prompted more stringent security measures for online learning such as requiring secure log-ins.

Moving forward, the Singapore Ministry of Education is systemizing, concretizing, and implementing a new educational technology plan to develop a technology-enriched school environment that is self-directed, personalized, collaborative, and human centered (MOE 2023). Keeping technology accessible, engaging, and safe should be a persistent priority for education systems when trying to harness technology for education.

3.3.2 Resilient Processes

Next, a resilient education system must have resilient processes on the ground. We believe that this is facilitated by adopting an ecological and whole-of-community approach where there is synergy between all agents of education to support each other in facing crisis. This is supported by the ecological systems theory (Bronfenbrenner 1992), which proposes both the immediate (e.g., family, peers) and wider social contexts (e.g., school, neighborhood, government, culture, law) influence student development. During the pandemic, the Singapore community spirit shone through in multiple ways to support those in need. Examples include record levels of donations for vulnerable groups, volunteers coming together to prepare care packs for frontline health-care staff, and the rise of innovative entrepreneurial solutions to help hawker centers whose businesses had declined significantly.

The pandemic showed how much value a strong community brings to its people. Communities should actively support our students' educational development. Indeed, it takes a village to bring up a child. School leaders, teachers, parents, and the wider community all play critical roles in shaping education and learning. This is further emphasized by the fact that learning no longer takes place within classroom walls. During home-based learning in Singapore, many parents took on teaching and supervisory roles for their children's learning at home. Teachers supported teachers by exchanging effective tips and advice on how to design learning environments using technology tools. Some shared their creations openly, such as when a group of teachers developed and released a digital game for teaching "hypothesis testing", an A-level math topic, making this resource available open source for all teachers of that subject.

Research shows that an ecological approach particularly benefits disadvantaged students (OECD 2012). This also became evident during Singapore's lockdown, when schools remained open for vulnerable students. These included children of essential workers who needed supervision while their parents worked, students from low socioeconomic backgrounds, and students with disabilities who required more in-person support. Schools and volunteers provided

meals, resources, and personnel for these students during this period. For our vulnerable students, sometimes community support makes all the difference.

Moving forward, the Ministry of Education has developed the Guidelines for School–Home Partnership to give students, schools, and teachers clarity on meaningful partnerships between schools and homes (MOE 2019). The Singapore Learning Designers Circle (SgLDC) has now been created, with more than 20,000 educators sharing and learning from each other's experiences with technology. In addition, Singapore is investing more on better developing and curating its neighborhood spaces for learning, such as museums, libraries, and playgrounds. An ecological approach will allow for resilience in our processes by rallying the efforts of our communities.

3.3.3 Resilient People

Finally, people are the foundation of a resilient education system. Developing resilient people through solid values-based education is thus crucial. Strong values serve as the foundational anchor that guides an individual's motivation and conduct. They can determine a person's actions in face of crisis and challenges. During the pandemic, the success of Singapore's disease control measures stemmed partly from a strong sense of social responsibility, imbued in citizens as vital to community well-being and critical for collective survival in the health crisis. The public responded to calls to get vaccinated to protect their loved ones and vulnerable members of the community. Public places gave priority to older residents to minimize their exposure to the virus, such as priority shopping hours.

Respect, responsibility, resilience, integrity, care, and harmony constitute the six values taught in Character and Citizenship Education in Singapore. During the pandemic, these values shone through, enabling learning to continue during the crisis. For example, students remained responsible for their learning, showcasing self-directed learning and curiosity to keep learning alive. Integrity ensured that they fulfilled their learning requirements despite reduced monitoring and accountability from teachers. They demonstrated resilience by adapting to new ways of learning. A Ministry of Education survey on students and their home-based learning experiences revealed that the majority of students indicated no severe disruption to their learning (MOE 2021).

Clearly, values are extremely important buffers against crises and setbacks. They have become increasingly important in our current world of profound pessimism and fragility. While the advent of technology and artificial intelligence offer possible benefits as

mentioned earlier, they also present major challenges to civic society. For example, students now have unlimited and unrestrained access to both accurate and inaccurate information. The rise of increasingly competent artificial intelligence and machine learning mechanisms heightens the risk of misinformation. Singapore's Minister of Education Chan Chun Sing identified sensemaking as a growing challenge for the younger generation. In his speech, he emphasized the need to "help our learners make sense and make choices anchored by our values." Given this information overload, students must learn to "distil and discern information, in order for real knowledge and wisdom to emerge" (MOE 2022). Another pertinent challenge highlighted by the pandemic is well-being, particularly regarding technology's potential negative effects on students' psychological and physical health.

In 2022, Singapore strengthened its Character and Citizenship Education curriculum to emphasize digital literacy, knowledge, and skills to help students better navigate cyberspace, including respect for boundaries and personal safety. It also focuses on socio-emotional competencies and mental resilience foundations of learners, including self-regulation and help-seeking skills. Moving forward, the creation of the Singapore Centre for Character and Citizenship Education, the first such research center in the region, signals a strong national commitment to focus on and build a strong value and character base among our people.

3.4 Conclusion

Resilience is the ability to bounce back from setbacks. This essay drew on Singapore's pandemic response to reflect on the resilience of its education system. While facing many challenges and setbacks, Singapore's education system maintained its strength during the COVID-19 crisis. Nonetheless, Ministry of Education research showed that the overall student performance in the 2020 national examinations was comparable to previous years' results, indicating no major learning losses (MOE 2021). Singaporean students also improved their performance on the PIRLS despite disruptions from the pandemic.

We thus conclude that a resilient education system should possess resilient structures, processes, and people to recover from crisis and withstand unpredictability. Structures influence policies, and the pandemic has taught us that systems must also adapt quickly. Technology, science, and big data are important catalysts for successful policy formulation. As such, post-pandemic Singapore continues to invest strongly in research and innovation. Effective policy implementation requires a holistic approach that emphasizes

coordination, cooperation, and clear communication. Multi-ministry taskforces act as interconnected networks, leveraging collaborative communication processes to foster pragmatic and proactive citizenship, especially to reach out to the most vulnerable groups. Ultimately, a society reflects the character of its people. Therefore, strengthening the social compact remains an ongoing challenge. The future readiness of societies depend on strong social cohesion and responsible national and global citizenship.

On that note, people are indeed crucial to any country's success. Singapore has always prioritized its people, a model we urge policymakers to consider when developing resilient systems. Starting as a developing country facing various social, economic and political problems, Singapore's state transformation focused on human capacity, citizenship, and nation building, among other factors. This helped create a prosperous and functional city-state with people of strong character and values. This paid off during the pandemic when social responsibility guided citizens' behavior in protecting community well-being. In education, teachers' and students' values and mindsets are fundamental. In 1966, Singapore's founding prime minister, Lee Kuan Yew, said to fellow teachers that "a teacher cannot really perform his duty unless he feels he is doing something worthwhile." Teachers are the decisive force in the classroom, greatly shaping students' impressionable minds. Teachers embrace their civic responsibility in nation building and developing the next generation. This mindset was a key factor driving Singapore's educational success. To this day, Singapore continues to prioritize its people, as signaled by the Singapore Centre for Character and Citizenship Education. Following the pandemic, opportunities remain to instill citizenship and care for humanity and to further develop exceptional people.

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PART II

Country-Specific Experiences

4

In Pursuit of a Resilient Education System: Lessons from the Republic of Korea's Response to the Pandemic*

Song Chang Hong and Sung Jae Park

4.1 Introduction

As in other sectors, the pandemic had a huge impact on the education system in the Republic of Korea (ROK). The education system responded to the coronavirus disease (COVID-19) pandemic in three sequential phases, though not without initial confusion, complications, and errors: from school closure to online classes to reopening schools with on–off blended schooling. Intensive efforts to transition classes to virtual schooling minimized learning losses for students, thus preventing what was a major public health crisis from also causing a huge crisis in the future.

Compared to other countries, the ROK was able to transition all its schools to online classes rapidly, and then to blended onsite and online classes since schools reopened (UNESCO n.d.). The conditions for online education were already favorable for remote learning prior to the pandemic. A national education digitalization project from the late

1990s made access to information and communication technology (ICT) networks and devices almost universal for households and schools. Moreover, online educational content had been enriched by past efforts of public institutions and private businesses. In spite of their familiarity with virtual environments, however, most teachers were not ready to hold their classes through online platforms. Students were already using online content but did not have the experience of interacting with teachers and peers in formal online schooling. The schools were utilizing online sources for after-school programs but had not migrated whole learning and teaching activities to virtual platforms.

It is important to differentiate clearly between "online learning," "online class," and "online schooling." Before the pandemic, individual students were actively using online learning for remedial or advanced courses or for homework and assignments. Online classes in a formal setting were limited to such education institutions as cyber universities and a few special cases. They require not only that teachers teach, but also that learners interact with teachers and peers virtually. And online schooling means that students are able to earn official credits through virtual attendance. Student evaluation or assessment is an important component of an online class, and it can be carried out online or in person. Online schooling thus means that all academic activities and administration services in the education system are conducted virtually, and that e-learning, even at the primary and secondary levels, can substitute for conventional schooling.

4.2 Three Phases of the Education System's Response to the Pandemic

From January to December 2020, the ROK's response to the pandemic in the education system occurred in three phases: school closure and postponement of the new semester (in February and March), preparation and operation of online classes (from April), and school reopening and on–off blended schooling (from May).[1] Figure 4.1 illustrates the

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[1]   After students resumed in-person classes, there were outbreaks of the Delta and Omicron variants of the virus. As information about the coronavirus continued to accumulate, data showed that teenagers faced lower risks of severe disease compared to adults. Many eligible individuals also had developed protection through vaccination or prior infection, with vaccination rates of teenagers aged 13 and above reaching 83% by April 2022. In addition, early studies, such as Kim et al. (2020), found limited in-school transmission, with only 3 out of 124 student infections occurring in school settings, while the rest were infected in the family, private academies, restaurants, and other public places. Based on such data, the government determined that widespread school closures were no longer necessary.

Figure 4.1: Daily Confirmed Cases of COVID-19 and Major Responses in the Education System in the Republic of Korea, 2020
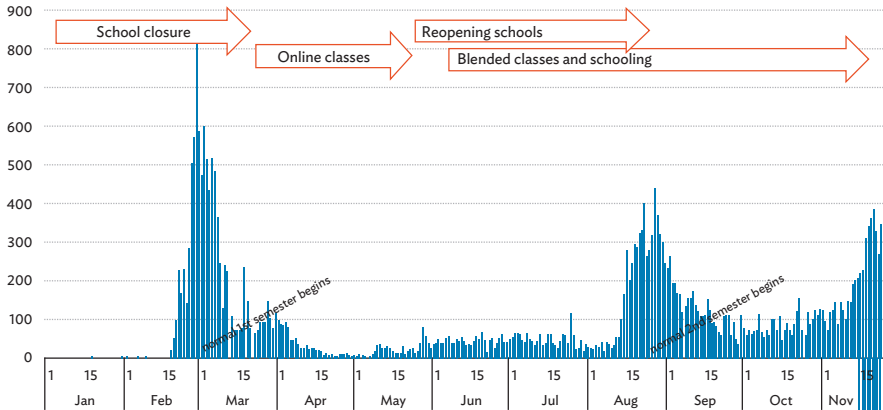
COVID-19 = coronavirus disease.

Source: World Health Organization (n.d.).

timing and phasing of the country's initial responses to the pandemic. The government's fast, orderly, and systematic response managed to minimize the ROK's schooling and learning losses due to the pandemic.

4.2.1 Phase 1: School Closure and Launch of a Countermeasure Task Force

The initial response to the pandemic was school closure to suppress the transmission of the virus. After the first domestic case of the disease was confirmed in January, the Ministry of Education (MOE) organized a monitoring task force on 20 January. It was headed by the vice minister and started issuing guidelines and instructions to local education authorities and schools. A month later, when the number of COVID-19 patients soared, the task force became the Countermeasures Headquarters of Education, chaired by the minister. Universities faced an urgent situation as foreign students needed to return from their home countries for the new semester. Following discussions with universities, the MOE announced guidelines for higher educational institutions. In particular, these guidelines relaxed the regulations contained in the Higher Education Act and its related decrees regarding distance learning credit limits, attendance requirements, and leave of absence policies.

The MOE also postponed the start of the first semester, normally 2 March, three times in accordance with the disease spread and the education system's readiness to implement the country's response. The Central Disaster and Safety Countermeasure Headquarters issued stricter distancing measures to contain the pandemic, affecting both private tutoring institutions and public facilities. The MOE and related authorities prepared and issued the Quarantine Guidelines for Schools on 24 March.

The school closures in March and April required corresponding changes in academic schedules. The MOE recommended a reduction in the number of school days, designating 190 days for elementary and secondary school and 180 for kindergarten. During the first and second closures, the number of school days was adjusted by reducing the length of summer and winter vacation, but after the third closure, the number of school days was cut further and class hours were reduced in proportion to the reduction.

To implement these changes, education authorities secured a special budget to support schools and students. The National Assembly passed an additional budget of $247 million for the MOE.[2] Financial grants for education in provincial areas worth $218 million were allocated to support emergency childcare, quarantine supplies such as masks and hand sanitizers, and online learning. Another $28 million went to support tuition fees for kindergarten students and their families, who still had to pay during the closure. And $1.6 million went to the Korea Education and Research Information Service (KERIS), which was designated as a support service center for institutions of higher education. This public agency helped universities make the transition to online classes through technical services and distance learning content.

4.2.2 Phase 2: Preparation of and Transition to Online Classes

On 31 March, the education authorities announced that classes would take place through an online platform starting on 9 April. Based on an operation guideline for online classes and a guideline on online attendance evaluation and records, schools and local education authorities gave detailed operation plans for online teaching and learning. They provided more online content and training for teachers and secured smart devices for those who were not equipped with them. The MOE

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[2]   The additional budget was equivalent of 0.4% of the original ministry budget for fiscal year 2020, $62.2 billion.

also revised the curriculum for the first and second grade of primary schools to reduce the burden on children and their families. To ensure an orderly transition to online learning, classes began on a staggered schedule, starting with the senior years of the middle and secondary schools, followed a week later with the lower grades of these schools and the upper grades in primary schools, and another week later, with the first three primary grades.[3] Kindergarten extended the suspension of classes until the criteria for starting school were met considering the developmental stage of young children, the characteristics of the play-oriented curriculum, the possibility of infection control, and the degree of preparation for school opening.

To ensure that schools were adequately prepared for online classes and schooling, the MOE instructed schools to undertake the following measures before online classes began:

- Schools and teachers from 1 April began preparing for online classes to prepare for opening day and support student adjustment to school.
- Schools and teachers devised online education plans and communication systems, provided guidance for students and parents, facilitated self-training for teachers, tested online educational platforms, and checked preparation for online classes.
- Schools prepared for full-scale online classes by setting 2 days after the start of school for each grade as an adaptation period for such classes, and allowed students to experience class content and learn to use the platforms. The initial adjustment periods for online school were included in the number of school days.
- During the adaptation period, school opening ceremonies and orientations were held online.

The MOE reinforced infrastructure for online classes, including a learning management system (LMS) and digital educational platforms including e-learning centers and Educational Broadcasting System (EBS) online classes. It also established a cooperation system with EBS and KERIS and promoted a self-directed learning environment by guiding education content through online learning websites until the third week of school closure, and encouraged teacher-managed online learning after the fourth week. It also set up the Online Distance

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[3]   The ROK has a 6-3-3 school system, which consists of 6 years of elementary school, 3 years of middle school, and 3 years of high school.

Education Preparation and Inspection Team to monitor online classes and to devise solutions for problems arising in schools.

Problems included unstable network connections and difficulties in logging onto the LMS due to heavy traffic, especially at the beginning of classes. To address these technological challenges, schools were permitted to use social network services and other private online classroom and learning platforms as well. In addition to official platforms such as EBS online class (https://www.ebsoc.co.kr/) and edunet operated by KERIS (https://cls.edunet.net/), private ones including Google Classroom, MS Teams, Classting (https://www.classting.com /ko), and several other commercial solutions were permitted as venues of virtual classes. Joint efforts by private firms and public agencies helped to stabilize the online system within a very short period.

4.2.3 Phase 3: School Reopening and Blended Classes

In early May, with the easing of social distancing restrictions, the MOE prepared to reopen primary and secondary schools. The MOE issued a revised version of the Quarantine Guidelines for Schools and the Guideline for Teaching and Learning at the primary and secondary levels to prepare for the reopening of schools. Actual physical attendance or in-person classes started on 20 May. This reopening followed four sequential phases, starting from the senior students in high schools and middle schools, and students were able to take their final examinations at the end of the term in their classrooms with their peers.

School attendance guidelines for online classes across all levels (kindergarten, elementary, middle, and high school) were set according to social distancing guidelines, as summarized in Table 4.1. Depending on the virus alert level, schools could preemptively migrate their classes to the online platform or could blend onsite and online activities. At Level 1, in-person and online classes were used in combination. Depending on school conditions, the recommendation was to maintain a daily student density of two-thirds at the school (or onsite). At Level 2, in-person and online classes were both used but at reduced student density for onsite classes. Kindergarten, elementary, and middle schools had to limit onsite student attendance to just one-third of capacity and high schools to two-thirds of capacity. In case of Level 3, the highest alert level, all classes were held online or schools could be shut down.

**Table 4.1: Guidelines for Online and Offline Classes
by Social Distancing Level**

Level	Level 1	Level 2	Level 3
Mode of instruction	Onsite and online classes	Onsite and online classes	Online classes or no school
Explanation	Maintaining two thirds of daily school attendance - Two-thirds of students could attend in-person classes	Measures to minimize student attendance at school using blended activities - Onsite (offline) attendance limited to one-third of student capacity for kindergarten, elementary school, and middle school; two-thirds for high school	Nationwide coherent response (in principle) - Flexible application depending on region's situation

Source: Ministry of Education (2020b).

For example, to prevent the spread of COVID-19, the government decided to require online classes from 26 August to 11 September in the Seoul metropolitan area. After the crisis and social distancing restrictions eased, in-person school attendance was resumed on 21 September. During this period, students had to attend classes every other day or every third day to maintain the rule of reducing student attendance to a third of a school's capacity. When the alert level was lowered to Level 1, first and second graders at elementary school were allowed to attend school every day.

4.3 Lessons from the Republic of Korea's Response to the Pandemic

Looking back to the later years of the pandemic, the country's education system was able to respond quickly and flexibly to the challenges associated with COVID-19. Learning from trials and missteps to develop guidelines for schools, the system transitioned well to a blended instructional approach of in-person and online classes. The overall strategy implemented by the government is summarized in Table 4.2.

A major challenge of the pandemic was to enable educational institutions at all levels to continue to operate effectively under

Table 4.2: Summary of Education System Response to the Pandemic

Phase	Major Actions and Events (Date)	Notes
1 - School closure	Nationwide school closures announced (23 Feb) Delay of new semester (2 Mar)	Parent–teacher survey on reopening schools
2 - Online classes	Official reopening of schools via online classes (31 Mar) Sequential opening of online classes from grade 12 (senior year of high school), grade 9 (senior year of middle school) (9 Apr) Grade 1 to 3 started online classes (20 Apr)	Parent survey about online classes (29 Apr–6 May)
3 - School reopening and blended learning	Reopening schools for high school seniors after 80-day delay (20 May) Grade 7, 5, and 6 return to school after 99-day delay (6 Jun) Flexible operation of online classes and schooling based on social distancing level (from 26 Aug)	Student–teacher survey on online classes (29 Jul–1 Aug)

Sources: Ministry of Education news releases.

unfamiliar and trying circumstances. Several factors contributed to the ROK's ability to respond to the pandemic, and there are lessons about building resilient education systems for the future and for other countries.

First, the country's centralized education system led the organized responses of local education authorities at the primary and secondary education levels. The MOE managed the enactments and regulations that regulate the administration, curriculum, and academic systems of teaching and learning, and provided the budget needed to implement the response strategy. In addition to the MOE, related public agencies, such as Educational Broadcasting System (EBS), Korean Educational Development Institute (KEDI), Korea Institute for Curriculum and Evaluation (KERIS), remained disciplined and aligned with the MOE's response strategy during the period of emergency.

Second, while the MOE provided the leadership in responding to the COVID-19 crisis, it engaged continually with teachers and parents by using surveys to collect information and views from these stakeholders

(Table 4.2). The ministry issued and widely disseminated specific guidelines, through news outlets, thus keeping those stakeholders informed about how the government was handling the unfamiliar environment.

Third, even prior to the pandemic, the ROK was poised to apply the new smart technologies needed to keep education going during the pandemic. The ICT infrastructure already available in the country, existing rich curricular content, and advanced technologies (including artificial intelligence and big data) could be deployed. Especially in higher education, after just one full semester of school closure, the system was able to transition to lectures, attendance, and even evaluation of both learners and instructors on an online platform. The accumulated experiences from 21 cyber universities and from the LMS of many institutions prior to the pandemic were shared with practitioners and administrators. Among primary and secondary schools, the transition to online classes was facilitated by nationwide digitalization strategies in key public sectors, including the education system, that started in the 1990s. These capacities were buttressed by universal access to internet networks and devices, making up a mature e-learning ecosystem consisting of public agencies and private businesses (Ministry of Science and ICT 2020). In addition, Korean students already had a comparatively high digital literacy (Fraillon et al. 2020).

Fourth, the public and private sectors collaborated to solve implementation problems related to the rapid transition to online classes. When the first online classes across the country began on 9 April, they faced serious technical problems. EBS, an online platform service provider, had the capacity to connect only 2,000 students simultaneously, whereas the need was to connect millions of students within 2 weeks. Private firms such as a cloud service provider (Microsoft Korea), an IT technical consultancy (LG CNS), and network service providers (SK, KT, and LG) helped EBS to tackle the technical challenges; their collaboration succeeded in effectively providing stable services for students and teachers (*JoongAng Daily* 2020). The three network service providers and the telecommunications ministry also agreed to provide educational institutions with free data service on educational content. Samsung Electronics and LG Electronics donated about 46,000 smart devices for students who did not have the equipment. In addition, the national association of textbook publishers permitted educators to use 749 types of publications, and 62 educational technology or edtech firms joined the national effort to transition to online classes by guiding their available contents (MOE 2020a).

The strategic response of the ROK to the educational crisis caused by the pandemic ignited a profound transformation of its education system. The approach relied on making virtual learning work flexibly

and effectively for teachers and students at all education levels. It took advantage of universal connectivity to global learning and communications networks, and overcame the previous hesitation to use smart technologies throughout the education system for instruction, as well as evaluations of students and teachers. There is greater openness to public and private providers of network and education services. More schools and teachers now utilize the learning content and technology-based LMS that edtech firms developed. With these changes, the country's education system is much better equipped to deal with the challenges of learners from future public health, natural, or political crises.

For developing countries, the pandemic was an especially tough time for students, parents, teachers, and policymakers alike. It would be another tragedy if this period of pain does not yield lessons, and if those lessons do not improve the resilience of education systems. An important lesson is that long school closures result in learning losses, particularly for vulnerable populations, exacerbating disparities, and thus must be avoided.[4] To minimize the duration of school closures, health and education authorities must work together to update and implement safety and hygiene guidelines according to changing situations. Their informed and agile responses can achieve both goals of safety and sustained learning in schools. To engage the support of stakeholders, close cooperation and open communication with local governments and communities and a system of continuous monitoring and reporting are critical.

When school closures are unavoidable, online attendance and good learning content can help to minimize learning loss by substituting for regular classes and students' after-school and supplementary learning activities. The success of this option requires reliable digital infrastructure, rich online learning content, and universal access to virtual networks for households and schools. It is important to understand that this digital transformation of education does not reduce the role of teachers. Success, in fact, depends heavily on teachers' ability and willingness to quickly acquire digital skills, adopt appropriate pedagogies that utilize digital content and delivery, and even generate or use content from global sources, including from more advanced education systems.

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[4]   Using Korean student performance data during the pandemic, Hahn, Kim, and Yang (2023) found that in-person schooling does not significantly affect average test scores, but it reduces educational inequality and enhances noncognitive traits such as class participation, school satisfaction, and career aspirations.

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5

Learning Through Disruption: Insights from Adaptive Policymaking in School Education During the Pandemic in Kerala, India

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5.1 Introduction: A Tale of Two Regions and Two Sectors

Kerala's first case of coronavirus disease (COVID-19) was confirmed on 30 January 2020, just 21 days after the People's Republic of China had announced the detection of the virus. With great alacrity, and not waiting for the national government's directions or even international guidance, the state government declared a health emergency, after just two more cases were identified on 2 and 3 February. A containment strategy was immediately put in place. In contrast, Italy where the first case was detected on 21 February, despite its more sophisticated health system, took effective containment measures only 4 weeks later, by which time the epidemic had engulfed much of the northern part of Italy. By the end of June 2020, Italy had over 34,000 deaths and Kerala just 23. Kerala's management of the pandemic quickly gained global recognition and acclaim from the World Health Organization (2020), World Bank, and other international institutions. Its innovative health measures continued for close to 2 years.

In school education, on the other hand, Kerala and Italy went down different paths. Kerala closed its schools on 10 March 2020, before the national lockdown, and opened them (partially) only 20 months later in November 2021, while normal school functioning resumed only in February 2022.[1] Italy closed its schools at the end of March 2020 and reopened them in September 2020, immediately after the summer holidays. Italy's approach was similar to that in Europe, the People's Republic of China, South Africa, Brazil, and other countries: open schools or offer hybrid learning even while the pandemic was running its course. Kerala followed the practice of other states in India in keeping schools continuously closed, though it took proactive measures to deliver education inputs. The impacts on children's learning and well-being were profound, as described later in this essay.

These comparisons illustrate that success in one sector does not necessarily ensure success in another, even when conditions appear to be similar. Learning from successes and, even more importantly, from failures is essential to prepare for the next crisis.

Using the framework of complex adaptive systems can help draw lessons from this experience. Such systems are characterized by many independent elements or agents that mutually interact and that are capable of adapting and responding to changes generated by these interactions, as well as their environment. Consequently, they exhibit features of nonlinearity, unpredictability and disproportionate effects, feedback loops, and dynamic behaviors.[2] The COVID-19 pandemic is an exemplary case of "non-linear phenomena, in that one small system perturbation may trigger disproportionate, exponential systemic reaction" (Angeli and Montefusco 2020).

This essay examines the experience of the state of Kerala in providing education during the pandemic through the lens of policymaking in complex adaptive systems. The next section presents the proactive measures taken by the Government of Kerala to ensure universal access to remote learning and, notwithstanding this, the decline in learning levels and negative impacts on children's well-being. The rest of the essay discusses the areas of focus and the approaches to be taken in policymaking when viewing education as a complex adaptive system, drawing examples from Kerala's experience.

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[1]   Schools were closed again during January 2022, due to the onset of the Omicron variant of the coronavirus. The only exceptions were to allow grade 10 and 12 students to take public examinations at the end of each academic year.

[2]   There is an extensive literature on policymaking in complex adaptive systems. Three useful pieces are Angeli and Montefusco (2020), which relates to adaptive policymaking during the COVID-19 pandemic, and two reports published by IDRC (Swanson and Bhadwal 2009) and OECD (Burns and Kosters 2016).

5.2 Kerala's Proactive Measures in Education During the Pandemic

While keeping schools closed throughout the pandemic, despite variations in its intensity and adjustments to the policies on social restrictions, the Government of Kerala took a very proactive stand to ensure remote learning. The measures were generally more comprehensive than those of most other state governments in India. Parallel interventions supporting health and livelihoods also protected family well-being and ensured that students did not drop out to care for the sick or to earn a livelihood.

Initial conditions in the state favored a better response compared to other Indian states. The state had achieved universal school participation, filled all teacher positions, and provided textbooks to all students. Over the past 2 decades, Kerala had also invested in integrating technology into high school education, creating materials, and training teachers. Although originally designed for school-based delivery, this experience allowed administrators to quickly train additional teachers. State policymakers effectively applied their earlier experience from managing the deadly Nipah virus outbreak and the aftermath of the devastating 2018 floods, which had displaced over a million people, to deal with health epidemics and large-scale disruptions to livelihoods and social services.

During school vacations in April and May 2020, the government successfully pivoted to online and remote learning. Both government data and independent surveys conducted in 2021 found high success rates in providing students with basic learning inputs and access to electronic resources. Textbooks were provided to all students, including in remote areas. The Kerala Infrastructure and Technology for Education agency began offering digital classes in June 2020 using its dedicated channel, which was made available through cable networks, web streaming, mobile applications, and YouTube. The State Council of Educational Research and Training equipped thousands of teachers in the use of basic digital tools and platforms, enabling them to contribute educational resources. Through extensive social mobilization, the government helped 250,000 children newly gain access to TV or mobile phones within 1 month. Televised classes were followed by online classes using a customized Google Classroom.

At the beginning of the pandemic, the estimated student engagement was very high, with about 150 million monthly views on the YouTube channel. Teachers reportedly interacted with students and parents, mainly using text messages on mobile phones. They organized competitions for language and creative expression to keep students

engaged. School leaving examinations for grade 10 and 12 students were organized on time.

On the face of it, therefore, these indicators suggest that the education system was ensuring continuity of learning under adverse conditions.

5.3 The Devastating Impact on Learning and Children's Well-Being

Alarming evidence about children's learning emerged only months after the pandemic ended. A 2022 survey across rural India found that Kerala suffered the steepest decline in primary school children's reading ability among all states (ASER Centre 2023). Only 39% of rural children in grade 3 could read at grade 2 level, compared to 52% in the previous survey conducted in 2018. Despite this drop, Kerala still ranked the highest among all states. Similarly, grade 3 children's ability to perform two-digit subtraction fell from 49% in 2018 to 39% in 2022. This dramatic drop followed years of modest but sustained improvements, according to ASER data from 2012.

The performance of children in government schools has been consistently lower than in private schools throughout the last decade. The 2022 ASER survey showed that learning levels in both school types across subjects (reading and mathematics) fell compared to 2018. In math, government schools experienced a steeper decline of 12 percentage points from 45% in 2018 to 33% in 2022 for subtraction, compared to private schools that saw a decline of 4 percentage points from 52% to 48% during the same time. For grade 3 reading, the decline was similar in both government (11 percentage points) and private schools (10 percentage points). These figures do not distinguish between private schools that are funded by the government (with students from similar backgrounds as government schools) and those that are financed through tuition fees (with students from wealthier families). Such data disaggregation may reveal even bigger gaps. (The survey excluded students in urban areas.)

These findings relate to literacy and numeracy skills at the foundational level. The impacts on language competence and conceptual understanding of mathematics, especially at higher grades, likely run deeper.

Apart from the impact on learning, school closures around the world seriously affected young children and adolescents' behavioral, attention, and emotional well-being, as well as leading to increased mental health issues. While Kerala lacks specific data, anecdotal evidence from teachers, parents, and medical professionals suggests that the pandemic has accentuated these problems.

5.4 Key Focus Areas for Policymaking in Complex Adaptive Systems

5.4.1 Identifying Agents, Heterogeneity, and Influential Interactions

In a complex adaptive system, "agents" consist of individuals (students, teachers, parents, etc.), groups or collectives at different levels (schools, district authorities, local governments, etc.), and subsystems (like the government school network). These agents are also highly heterogenous. Their interactions, along with initial conditions and feedback loops, determine the system's evolution. Because listing every agent or highlighting every possible interaction is virtually impossible, identifying key agents and their most influential interactions is critical for assessing the possible impact of policy.

For student learning, the most important interactions occur between students, teachers, families, and peers. Children learn better through meaningful and structured interactions with teachers, as well as social interactions with their peers, which also foster enjoyment and motivation. These primary interactions exist within a broader network of relationships among teachers, school heads, administrators, and political leaders.

From this perspective, the Government of Kerala focused on maintaining connections between teachers and students through remote learning when many other interactions were also disrupted. Indeed, government officials confirmed this as their main objective during the initial phase of the pandemic.

While this approach suited the early stages of the pandemic when knowledge of the virus and its evolution was limited, a uniform school closure policy with exclusive reliance on remote learning failed to account for the heterogeneity in the system.

Despite its advances in ensuring universal participation, Kerala's education system is highly stratified and unequal. Government schools and most publicly aided private schools primarily serve poor and marginalized groups, while self-financed private schools attract wealthy households. The respective enrolment shares in these three types of schools were 29% (government schools), 46% (publicly aided private schools), and 25% (self-financed private schools).

This heterogeneity affects the manner in which students, teachers, and administrators interacted with each other in different types of schools. Students in affluent private schools benefited from teachers and school administrators who were able to deploy and use technology more effectively. They had access to computers at home (rather than

mobile phones), with more educated parents and family members who earned steady incomes, worked remotely, and possessed stronger digital skills. These families also continued private tutoring through online platforms and resorted to digital tutoring, as shown by the exponential rise in the use of educational apps that private companies developed and sold. A 2020 phone-based survey (ASER Centre 2021) found that 93% of rural government school students had access to a smartphone at home and 84% to a TV. However, access was not exclusive and these devices were often shared with working parents, limiting interactions with teachers as a result. Also, children in government schools and from poorer backgrounds lacked access to additional resources such as online tutoring and educational apps.

Language of instruction is another source of heterogeneity. About 70% of children across government and private schools study in English, using English textbooks and taking assessments and examinations in English. However, actual classroom practices differ. In English medium streams in government schools, teaching is effectively conducted in Malayalam because of weak English language proficiency among teachers and students alike. In short, children rely on interactions in their native language despite being formally enrolled in English medium classes and using English textbooks. Yet, TV broadcasts for English medium students aired solely in English, making it difficult for students in government schools to follow them. Their non-English speaking parents were also not able to support them. While classes were also broadcast in Malayalam, they targeted Malayalam medium students and used a language-specific syllabus and textbooks that were not interchangeable with those in the English medium stream. Regional variations in teacher availability and internet connectivity added to the heterogeneity in the system.

Applying a one-size-fits-all policy led to uneven learning outcomes and likely widened the learning gap between privileged and disadvantaged students, mirroring global trends.

Understanding the agents within the system—students, households, teachers, and others—and their crucial interactions, as well as acknowledging their diverse characteristics is essential for formulating policy. Such a systematic understanding could have prompted policy adaptation over time toward hybrid learning and periodic face-to-face interactions between teachers and children in community spaces or schools with safe social distancing measures, especially during phases in the pandemic when infection rates subsided.

5.4.2 Analyze Feedback Loops

The elements or agents in a complex adaptive system mutually interact, creating feedback loops that may amplify or dampen initial "perturbations." Policies that are based on understanding these connections and mechanisms are more likely to succeed.

An important feedback loop in education occurs in the classroom, between teachers and children and among their peers. A motivated and knowledgeable teacher and a vibrant learning environment can inspire students to learn, which in turn can further energize the teacher and generate positive peer dynamics among students. The opposite is also true. Difficulties managing the class can demotivate the teacher, causing students to lose focus or reduce effort, creating a downward spiral. This feedback loop can therefore amplify initial disturbances and likely affect disadvantaged children more severely.

The extended school closure policy created ripple effects through these feedback loops. As remote learning continued for months, interactions between students and teachers through WhatsApp messages or phone calls with parents became hard to sustain. Social isolation and economic distress also led to a rise in mental health problems among young people, making it more difficult to engage in learning and magnifying the negative effects of school closures. In turn, teachers in these schools struggled to cope with these mounting challenges. Over time, many children, especially from poor backgrounds, effectively "disengaged" from learning, creating obstacles for their future education.

A deliberate analytical process is required both during policy design and policy implementation to identify and isolate dominant feedback loops in a system. The principle of "everything is connected to everything else" in a system, if left at such a high level of generality, would cause policy paralysis. Isolating the cause–effect relationships between key elements (which can be bidirectional) and assessing whether feedback loops are reinforcing or attenuating initial perturbations will help to identify how policy outcomes are impacted.

5.4.3 Prepare for Unpredictable Effects

Complex adaptive systems are inherently unpredictable because of the multiplicity of interactions among elements and actors whose behavioral changes defy complete understanding. For example, Kerala (and other states) experienced one important unanticipated change during the pandemic: children transferring from private to government schools because large losses in employment left households unable to afford

school fees. According to ASER Centre (2023), rural children enrolled in private schools in the state declined from 47% in 2018 to 35% in 2022, indicating that thousands of children changed schools. Even larger shifts possibly occurred in urban areas. These changes must have been known at the local level in real time, even though the report appeared after the pandemic.

Transferring from private to government schools meant an abrupt and involuntary change in many children's educational experience. They would have struggled with new social and educational contexts, teachers, and peer groups, while schools closures added to their emotional strain. Many also shifted from English medium to Malayalam medium instruction, using different textbooks and syllabi, compounding their learning difficulties. Although Malayalam was their mother tongue, they would have been unfamiliar with its use in academic settings. At the same time, teachers struggled to integrate newcomers into remote classes, often without meeting these children in person. This process reinforced the feedback loop identified earlier.

While, by definition, such effects cannot be anticipated, the key is to quickly identify them, assess their impact on desired outcomes, and adjust policy as required. Nationally, the bureaucratic requirements for official student transfers were simplified, partly to deal with the massive exodus of interstate migrants during the March–April 2020 national lockdown, and Kerala adopted this policy adjustment. However, the deeper implications for children's learning and socio-emotional development required further policy adjustments and support to teachers and local-level officials.

5.5 Approaches to Implementing Adaptive Policymaking

5.5.1 Continuously Rearticulate Policy Goals

While schools remained closed, education policy in Kerala stayed largely static after the initial shift to emergency remote learning and failed to move from a reactive phase to experimental and stabilization phases in response to changes on the ground.

The initial policy challenge undoubtedly was: How do we provide universal access to online or remote classes? But as schools remained closed for months, instead of weeks, the policy question could have evolved to: What does education to promote children's learning and well-being look like, without classrooms and school buildings? Here, classrooms and school buildings represent the social context in which

formal learning took place. Such a reformulation of the problem and of the goal of policy would have required adjustments to the approach. Further, it might have led to questioning whether keeping schools closed for so long without any face-to-face interaction was the appropriate policy.

While policymakers could initially formulate policy for ensuring universal access to remote learning from the view from 30,000 feet, which could be applied uniformly across schools, the new challenge required focusing on interactions between teachers and students and how these interactions and behaviors changed. This required ground-level data to understand how feedback loops were amplifying or stabilizing the initial disturbances to learning processes and to make adjustments to both delivery mechanisms and teaching processes.

5.5.2 Collect New Information Systematically but Parsimoniously

Traditional data, collected at periodic intervals to monitor relatively stable systems, are less relevant for decision-making during disruptions. Policy goals also determine what data are collected. In Kerala, ensuring enrollment was an important objective and was monitored, but children's attendance in online or remote classes was not.

Despite Kerala's numerous activities to engage children in remote learning, very little information emerged about the effectiveness of these measures, let alone learning progress or regression during school closures. Data on downloads of education materials from websites or of "views" on remote channels, while useful at the beginning to monitor student (or parental) engagement, were poor proxies of learning. This lack of data impeded adjustment of policy goals, while the exclusive focus on ensuring access to remote learning may have precluded collecting more relevant data.

For adaptive policymaking, it is essential to identify which data are useful to understand the evolution of the system (for instance, focusing on key interconnections) and what can be feasibly collected. Qualitative information from multiple sources, when collected and analyzed systematically, can be powerful aids to decision-making. Data collection and analysis at lower levels of the administration also reduce costs while allowing for policy adjustments. The Government of Kerala demonstrated this approach in managing the pandemic by establishing district control rooms for health, using local information to finetune local responses and inform state-level policy. Dashboards and other digital tools relating to the epidemic helped with monitoring, decision-making, and communication with the public.

5.5.3 Rapidly Adapt Relevant Global Knowledge to Local Contexts

Systems rapidly accumulate knowledge by assimilating and sharing experiences with other systems. In Kerala, this happened very quickly and systematically in the health sector, but only minimally, if at all, in education. This differential response in the health system might stem partly from prior experience with infectious outbreaks, the quality of health personnel, and their greater integration in global networks at the policy level.

In particular, the policy on school closures was not changed despite the growing global evidence of the negative impacts on children and changing international practices within 6 months of the onset of the pandemic. Although almost all countries initially shut down schools, especially due to limited knowledge about how children were affected by or could transmit the virus, policy decisions on school opening began diverging across countries within 2–3 months. Multiple research studies generally found children's susceptibility and role in spreading the infection to be low. Early research in Europe also showed deep negative impacts on academic performance and socio-emotional well-being, with widening inequality.

By April 2020, provinces and lower levels of the educational administration in the People's Republic of China were allowed to open schools based on criteria about the spread of the infection. Some European countries, such as the Netherlands, had also reopened schools by spring 2020, and most European countries had done so by fall 2020, at least in hybrid form. Even most eastern and southern African countries reopened schools by January 2021. All these countries based their school opening policies on the local outbreak intensity over time. .

The contrast between Kerala and other Indian states' cautious approach to school reopening versus their willingness to reopen shopping centers and workplaces warrants further investigation and reflection. National policy may have influenced or constrained state education policy (though this did not happen in the health sector). Until around August 2020, the Government of India explicitly advised school and college closures nationwide. Subsequently, the guidelines continued to caution against children congregating in schools and public places, even though this diverged from global practice by then.

5.5.4 Promote Variation in Policy Implementation While Adhering to Overall Goals

In systems with diverse agents, multiple interactions, and feedback loops, varied policy implementation is more likely to succeed. This variation also builds greater resilience in the system for future crises by generating lessons from multiple approaches. A standardized response to the unpredictability of complex adaptive systems can lead to failure.

Promoting variation and policy experimentation during a crisis may seem counterintuitive, especially with limited administrative capacity and resources. There are obvious political risks for a government that adopts seemingly differential policies for different groups of students, as it may face accusations of discrimination. In reality, a superficially "equitable" policy can gravely affect children who are already disadvantaged and worsen future inequality. To mitigate these risks, governments should clearly communicate their equity-focused policy goals for children's learning and well-being, as well as different pathways to achieving them.

A differentiated approach could have provided compensatory support to create better learning environments for disadvantaged children, especially in government schools and in coastal and tribal regions. This may have required mobilizing additional volunteers to teach in smaller groups or follow up with children, using community spaces for periodic face-to-face interactions. The current system (for government and aided schools) does not allow for such differentiation, an important lesson for building future resilience.

Mobilizing Discovery at the Grassroot Level

During periods of great uncertainty, allowing different solutions to emerge strengthens the overall functioning of the system. No expert could provide proven "best practices" because there was no precedence for the mass transition to remote learning. Further, evolving circumstances required new solutions to be developed periodically.

Kerala's education system has a history of volunteer teacher networks that share information and learning. These networks proved valuable during the pandemic as many individual teachers contributed learning resources and tips for teaching online or remotely. Further, encouraging teachers and schools to experiment with different models of teaching would have strengthened the process. A continuous learning plan for each school, adjustable based on local circumstances and over time, could have enabled adaptation within this complex situation.

Decentralized Decision-Making

Using the perspective of complex adaptive systems, "decentralized decision-making allows the decisions to be made at the level where the feedback loops are the tightest, which will allow for quicker and better response to unforeseen circumstances" (Swanson and Bhadwal 2009). This would have been at the school and local government level, with specific decisions allocated to each agent.

In Kerala, private schools (both aided and unaided) enjoy a greater degree of autonomy and decision-making power. However, government schools are more centralized. The pandemic's disruptions offered an opportunity to devolve greater responsibility for decision-making to support children's learning and introduce innovations at the school level. Kerala's local government system was effective in managing the pandemic and delivering social assistance programs, with community participation and an effective chain of command from the village to the state level. This model could extend to education.

As discussed earlier, reformulating the policy goal was crucial. Implementing this revised goal might appear challenging if viewed as a centralized measure requiring statewide consensus across multiple stakeholders, with requirements to create new processes, supervision methods, reports. However, allowing local-level creative solutions, precisely because of the system's complexity, could have provided a more effective, if counterintuitive, solution.

5.6 Conclusion: Every Disruption a Learning Opportunity

The COVID-19 disruption to school systems has taught us many lessons. Much has been learned about how to use technology and the need for universal internet access. It has also taught us that technology proves ineffective without meaningful teacher–student interactions and the social environment of learning. The disruption has also exposed preexisting problems, including deep inequalities and a lack of attention on learning, which need to be addressed to build system resilience.

Traditional policymaking follows a unidirectional approach, where policymakers determine the "right" policy (often aiming to optimize system "performance") for others to then implement. In contrast, adaptive policymaking explicitly recognizes that mutual interactions among multiple agents give rise to various possible futures that may not even be fully anticipated. Achieving successful or desirable outcomes requires not only addressing but also working with these characteristics of complex adaptive systems.

Building the capacity of policymakers to address the challenges of complex adaptive systems, drawing on these lessons, will help tackle future challenges. While Kerala's health sector responded better for many reasons, two contributing factors were widespread internalization of lessons from previous epidemics and adoption of more flexible and adaptive policies.

International agencies play an important role in disseminating lessons learned. Much of this effort has been focused on collecting data on learning losses and global evidence on what works. Research should also examine how education systems function as complex adaptive systems in general, particularly the initial conditions, interactions, and processes that shaped policy responses during the COVID-19 pandemic.

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6

The Asymmetric Effect of Conflict on Education: Lessons from the West Bank

Michele Di Maio

6.1 Conflict and Education

More than 1.7 billion people live in countries affected by violence and conflict (ACLED 2023). While most conflicts occur in some of the poorest countries in the world, political instability and violence are situations affecting countries of any level of development. Recent events in Europe demonstrate how political tension can quickly escalate into conflict, even in developed economies, raising concerns about mounting tensions across Asia.

A recent, yet rapidly growing, literature documents the devastating and long-term lasting economic consequences of conflict (Verwimp, Justino, and Brück 2019). Among the most pervasive of these effects are those on the education system and the educational outcomes for children and adolescents (UNESCO 2011). Education is the key to economic development and individual well-being, both from a historical perspective (Becker 2022) and considering its role as an engine of long-term growth (Porzio and Rossi 2022). This is why it is so important to understand how conflict impacts education and how to minimize its short- and long-term negative consequences.

The existing empirical evidence indicates that the effects of violent conflict on education are negative but also highly heterogeneous. The magnitude of the effects depends, among other elements, on the type of conflict (civil war, interstate war, terrorism, etc.) and the type of violent events (killings, abduction, etc.), on gender, and on the education outcome considered (school enrollment, attendance, attainment, etc.) (e.g., Chamarbagwala and Morán 2010; Shemyakina 2011; Leon 2012;

Di Maio and Nandi 2013; Valente 2013; Justino, Marinella, and Salardi 2014; Monterio and Rocha 2017; Bertoni et al. 2019; Michaelsen and Salardi 2020).

One aspect that has received little attention so far is the effect of conflict on academic achievement for high school students and the mechanisms underlying such effects. Answering these questions is important because academic achievement is a predictor of future earnings, especially when university admission is determined by high school final exam performance. Moreover, learning about the effects of conflict on high school students is crucial for a better understanding of the impact of violent conflict on the development prospects of an economy, given that these students will make up a large part of the country's high-skilled workforce in the future.

6.2 Conflict and Education in the West Bank During the Second Intifada

Our essay (Brück, Di Maio, and Miaari 2019) documents the effects of violent conflict on high school education in the context of the West Bank during a period of intense violence. The Second Intifada (also known as the Al-Aqsa Intifada) started in September 2000, ending the relatively peaceful period that followed the 1994 Oslo Accords. The Second Intifada was characterized by frequent clashes, with numerous violent acts and thousands of fatalities on both sides (B'Tselem 2007). Although the intensity of violence varied over time and space, the conflict persisted throughout the entire period. While there is no official end date, violence decreased substantially after 2006.

The West Bank during the Second Intifada is an ideal setting to study the effect of conflict on education, particularly on the academic achievement of high school students for two reasons. First, high school enrollment in the West Bank has always been high by international standards, as in several Asian countries. Second, the Palestinian education system continued operating even during the conflict. The fact that schools remained open and students (even if with huge difficulties) continued to attend classes is not uncommon in conflict- and insecurity-affected situations such as Nigeria, Libya, and more recently Ukraine. This is a characteristic common to several other violence-affected countries, including in Asia where conflicts often severely affect education but do not completely disrupt it.

The structure of the Palestinian high school system is similar to that of several developed and developing countries. The secondary education cycle consists of either a vocational or an academic track

and includes grades 11 and 12. At the end of these 2 years, all students take a final exam called the Tawjihi General Examination. The exam takes place on the same day (at the end of the academic year around the end of June) in all schools in the West Bank, under identical conditions. An external commission nominated by the Ministry of Education and Higher Education grades the exam. To pass the final exam, students have to score more than 50% in all subjects included in the test. Students who do not pass the exam can retake it the following year. The Tawjihi Certificate is the high school completion certificate required for students who wish to pursue undergraduate studies. The exam test score determines the likelihood of being accepted by a local university or abroad and which subject the student can study. In the West Bank, the minimum score for university admission is 650. The minimum test score required for admission to some university subjects (e.g., engineering) or as a foreign student to most universities in other countries in the Middle East is 850.

6.2.1 Main Findings

Our analysis takes advantage of unique and detailed individual-level data on exam results for all high school students in the West Bank. This allows us to provide the first empirical analysis of the effects of conflict on the academic achievement of high school students. Specifically, we study the effect of conflict on individual final high school exam (Tawjihi General Examination) results of Palestinian students in the West Bank during 2000–2005.

Our empirical analysis proceeds in two steps. First, we measure the impact of living in a conflict-affected location on individual academic achievement. Following previous studies in the conflict literature, we measure the intensity of the exposure to conflict by the locality-level number of Palestinians killed during the academic year. In our analysis, we compare the exam results obtained by students enrolled in the same school during the various years of the Second Intifada. This allows us to compare students that have received the same type and quality of education (they are enrolled in the same school) but that have been differently exposed to conflict, as measured by the number of Palestinian fatalities that have occurred in the locality of the school during the corresponding academic year. Our results show that the higher intensity of the conflict to which the student is exposed (i.e., the larger the number of conflict-related events that occurred in the locality of the school), the lower the probability of passing the final exam, the total test score, and the probability of achieving the minimum test score needed for university admission. The size of this negative effect is not small. An increase of 100 in the number of Palestinian fatalities that

occurred in the locality of the school during 1 academic year reduces the probability of passing the exam for the average student by around 7% of the mean (which is 74%).

6.2.2 Heterogeneous Effects

Our results also show that while conflict reduces students' probability of achieving the minimum test score required for admission to university (which is higher than that needed to pass the exam), it does not reduce the probability of achieving the minimum test score necessary for admission to universities abroad (which is higher than that to be admitted to a local university). The magnitude of the effect of conflict is heterogeneous along the total test score distribution. We interpret these results as suggesting that the effect of conflict is heterogeneous across levels of academic ability, with high-ability students possibly being *less affected* by conflict. Higher conflict intensity has no effect on students who have better abilities and/or better educational backgrounds. Our results also indicate that the effects are slightly more negative for mathematics compared to Arabic language, and there is no evidence of a gender differential in the effect of conflict on the probability of passing the exam or on the total test score.[1]

6.3 Mechanisms Behind the Effect of Conflict on Education

Measuring the effect of conflict exposure on education is crucial to motivate policy interventions. Learning about the size of the effect is important to understand how large and thus how severe the consequences of the shock are. At the same time, it is important to distinguish the groups, types, and categories of individuals who are more likely to be affected and those who are less so. The differences may be large so they must be taken into account when designing policies that address the consequences of conflict in the most efficient way. However, all this information needs to be complemented with a precise understanding of the mechanisms through which the effect of conflict, and its heterogeneous impacts across groups, materialize. Without such analysis, policies cannot be designed properly and may just lead to a waste of resources. The same outcome, say a larger negative effect for low-ability students, may be the result of very different mechanisms.

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[1] Previous research documented that exposure to conflict can result in large gender gaps in individual educational outcomes (Chamarbagwala and Morán 2010; Shemyakina 2011; Valente 2013).

Without a proper analysis of those mechanisms, we are blind in terms of how to intervene effectively to reduce the negative consequences of conflict.

In the context of the West Bank during the Second Intifada, we document the existence of two distinct transmission mechanisms from violent conflict to reduced academic achievement. As a first mechanism, we show that conflict negatively affects academic achievement by reducing the quality of the learning environment at school. In particular, conflict increases the level of overcrowding in classrooms, i.e., it increases the number of cases in which there is an excessive number of students in the same classroom.[2] We document that students attending classes in overcrowded classrooms have a lower probability of passing the final exam. This suggests that conflict, by making too many students stay in the same classroom, makes it more difficult for them to learn. This may be for several reasons including that teachers in an overcrowded classroom have limited time to help those more in need, that the number of class interruptions by students is higher, and that basic furniture (e.g., desks and chairs) are not adequate. Interestingly, we also find that the negative effect of higher overcrowding in the classroom on test scores is significant only for lower-ability students. This suggests that students who are relatively less able or possibly who are from a more disadvantaged educational and social background are also those for whom the quality of the learning environment at school is more important and thus are more likely to suffer from the impact of conflict-induced destruction of school infrastructure.

As a second mechanism, conflict worsens academic achievement by negatively affecting students' psychological well-being. Evidence suggests that the more likely a conflict-related violent event (i.e., of a Palestinian by the IDF) is to occur close to the place of residence of a student, the lower the probability of that student passing the final high school exam. In other words, direct exposure to conflict reduces the student's probability of passing the exam. This effect is larger when the person killed in the event is young. This is indicative of a possible mechanism of self-identification, particularly common in conflicts that

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[2]   Anecdotal evidence suggests two main reasons for the conflict-induced increase in the level of overcrowding in the classrooms. First, military attacks and school occupations damaged and, in some cases, destroyed premises and properties of Palestinian schools. Classrooms became unavailable due to the destruction of walls, doors, windows, and furniture, causing a shortage of classrooms (Giacaman et al. 2002). Second, the conflict situation has reduced the number of school construction permits (which are managed by the Israel government), preventing the enlargement of existing schools and building of new ones (which was needed given the growing number of school-aged Palestinians).

mainly occur in urban centers and characterized by numerous young victims. Finally, we find that the negative effect of direct exposure to conflict-related violence is largest for conflict events occurring shortly before the exam date (i.e., 1 month before), providing support for a psychological mechanism being at work.[3]

These results confirm the finding of previous studies showing that the negative psychological impact of the worsening of security conditions is an important element to be considered to understand the determinants of students' academic performance (World Bank 2006).[4] Another element that needs to be taken into consideration is that young Palestinians are exposed to conflict-related violence not only through direct or indirect experience but also through intense media coverage. As reported by Save the Children (2003), children often talk about conflict-related incidents seen on television. In addition, it is common for images of Palestinians killed to be displayed in public places, including school walls. The intense media coverage of the conflict is thus likely to negatively impact students' psychological well-being and their academic achievements.

6.4 Policy Implications of Our Findings

Maintaining learning continuity during a disruption is crucial to protect education accumulation. As is well known, school dropout is difficult to revert (Di Maio and Nandi 2013). Our findings provide some indications on how to minimize the negative impact of school disruption and to *maintain learning continuity for all children*. Which specific intervention should be chosen depends on several factors. In any case, to tackle these objectives, all actors involved in the education system (students, teachers, parents, and the community) have a role to play.

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[3]   We also consider other possible mechanisms. We find that conflict intensity is associated with more school closures and more student and teacher absenteeism. Yet, due to severe data limitations on these variables, we cautiously interpret the overall empirical evidence on these mechanisms as being inconclusive.

[4]   These results are in line with psychological research that has documented conflict exposure as the origin of high levels of emotional and behavioral problems, psychological disorders, and a reduced ability to concentrate on their studies in adolescents (Thabet, Abed, and Vostanis 2002; PCBS 2004). Pedersen et al. (2001) reported that heavy shelling and attacks directly affect students' concentration on schoolwork and make final exam preparation more difficult. Giacaman et al. (2002) found that the experience of conflict-related violence is a strong predictor of depression-like states that in turn may affect academic performance. Taken together, this evidence supports the view that the psychological channel plays a role in explaining the negative effect of the conflict on the probability of passing the final exam.

Each student is unique, which explains why exposure to conflict affects students' education differently. However, conflict impacts learning in several common ways. As we have seen, conflict worsens the quality of the learning environment. Conflict often also reduces learning time by making it impossible for students to go to school. For instance, student absenteeism increased during the Second Intifada. At the same time, anecdotal evidence indicates that schools had to be closed and normal schooling activities discontinued for security reasons (MOEHE 2005). The reduction in the quantity and quality of learning time at school is an important determinant of students' academic performance. In a context of disruption, one way to reduce these negative effects would be to help students to continue learning independently. This would (at least in the short run) minimize the negative impact of the shock. This possibility, however, crucially depends on a child's characteristics, including age, capabilities, and socioeconomic background. We expect students with lower abilities and less parental support to have more difficulties learning independently, so they need greater support. In sum, interventions to allow students to continue learning during a disruption have to combine individual-specific and common elements.

To continue learning during a disruption requires different types of interventions. Some can be anticipated in form and size, such as restoring damaged infrastructure and school facilities. These interventions are crucial to provide a place to study, something which is most needed by low-income students. Other needs are individual specific and more difficult to predict as to type and intensity. As our findings indicate, the psychological impact of conflict is crucial to understand why exposure to violent events affects academic achievement so severely. Unfortunately, this psychological trauma is often not properly addressed, partly because delivering this type of support is difficult. Yet, this need should be given high priority, especially in the case of children and adolescents.[5]

In this attempt to preserve continuous learning, the role of parents is key not only in terms of dedicated time and psychological support but also of material needs. The extended family and the community should also contribute to filling in for the period of disruption by organizing classes and study groups and by providing material help, e.g. a physical place for classes and study.

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[5]   For a description of the mental health system in conflict areas and of programs providing support for conflict-related psychological trauma, refer to WHO (2006); Espié et al. (2009); Giacaman et al. (2009); Qouta et al. (2012); Barron, Abdallah, and Smith (2013); Marie, Hannigan, and Jones (2016); and El-Khodary and Samara (2020).

Teachers' tasks become even more difficult during disruptions than in normal times. They face problems related to more frequent class interruptions, school cancellations, workload increases, and the management of traumatized children. They have to protect their students, continue classes in difficult conditions, and motivate and maintain the student's interest.[6] The ability of teachers and principals to be prepared to deal with disruptions will depend on (monetary and non-monetary) school resources, including continuing to pay salaries and ensuring functioning school infrastructure and facilities. The priority is that schools keep operating, but this is not enough. Teachers need to be prepared and trained to deal with negative shocks to guide students in difficult periods—and this needs to be done before a disruption occurs.

6.5 Concluding Remarks

While each conflict is unique, most have similar negative impacts on education. What varies are the magnitude of the effects, the groups of students and teachers most affected, and the mechanisms through which these negative impacts manifest. Understanding these heterogeneous effects and being able to explain them is key to designing effective policy measures.

Focusing on the Second Intifada in the West Bank, our analysis documents that the conflict reduces Palestinian high school students' probability of passing the final exam and the total test score. Moreover, our findings suggest that conflict exposure may have long-lasting consequences. By reducing the probability of students successfully completing high school and being admitted to university, conflict significantly hinders human capital accumulation and economic development. Conflict has a negative effect on the performance of lower-ability students while its impact on high-ability ones is not significant, suggesting highly asymmetrical effects across students, possibly related to differences in economic and social background. Its disproportionately larger effect on lower-ability students may imply that conflict would further worsen inequality through its adverse impacts on learning and

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[6]   The effect of conflict on teaching quality is a priori ambiguous. Teachers experience difficult situations that may have both positive and negative effects on the quality of their teaching. Some teachers reported being chronically exhausted with a decline in their performance; others experienced a sense of increased commitment, covering other delayed or absent teachers and providing special care to the students (Nicolai 2007).

education.[7] This is a potential long-term cost to be added to the already documented negative consequences of conflict on education.

Conflict negatively affects students' academic achievement by degrading both their school learning environment and psychological well-being. Our results suggest that any policy intervention aimed at mitigating the negative effects of conflict on education outcomes needs to take into consideration these two aspects.

While our findings are related to the context of the West Bank during the Second Intifada, the lessons we can derive apply more generally to countries in Asia and the Pacific. Our policy suggestions are particularly relevant for contexts experiencing long-term, severe—but not extreme—disruptions, where education systems are disrupted but do not collapse. This includes regions such as Asia and the Pacific experiencing long-term, low-intensity conflicts, natural hazards, health crises, or other similar negative shocks that may affect schooling in a country or a specific area of a country.

Resilient education systems maintain learning during disruptions, while providing mental health and social support to students and education personnel. In particular, they offer enhanced support to vulnerable students (those with lower academic abilities and worse socioeconomic backgrounds) and to teachers exposed to violence. During disruptions, learning continuity relies on a combination of instruments and interventions, including autonomous learning, remote teaching, and informal study groups. Digital tools, which are now part of most teaching systems worldwide, can be an important instrument to manage temporary disruptions from conflicts, extreme weather events, and other crises. The coronavirus disease (COVID-19) pandemic demonstrated various ways to leverage these new technologies, particularly for short-term disruptions when digitalization becomes the primary crisis response. However, to effectively use these instruments *during* a crisis, students and teachers need to learn and know how to use them *before* a crisis occurs. Advance training and preparation are key for managing both the short- and long-term consequences of the disruption. As violent conflicts are likely to persist, we need to design education systems able to cope with disruptions and minimize their negative effects on students, teachers, and the overall population.

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[7]   As the research on the effects of the coronavirus disease (COVID-19) pandemic on education has shown, negative shocks to the supply of education are likely to have severe negative impacts on the economic opportunities of the young in the long term (Fuchs-Schündeln et al. 2020). These effects can be particularly negative for low-achieving students with a disadvantaged socioeconomic background (Grewenig et al. 2020).

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7

Lessons from Government and Community-Based Efforts to Mitigate Learning Losses During the Pandemic in Cambodia

Sorin Var and Janes Imanuel Ginting

7.1 Introduction

Cambodia had one of the strongest responses during the coronavirus disease (COVID-19) pandemic, achieving one of the highest vaccination uptake rates, maintaining low case numbers and casualties, and sustaining a positive economic growth trajectory. Nevertheless, the pandemic had a significant negative impact on the education sector. Cambodia had one of the longest periods of school closure in the region, with face-to-face education suspended for more than half of the official school calendar in 2020 and 2021 (UNESCO 2022). The school closures resulted in the disruption of learning in all of the country's 13,842 schools (primary and senior), affecting 3.2 million students (MOEYS 2021). Cambodia implemented several approaches to provide continuous distance learning opportunities for all students.

Following the reopening of schools in late 2021, the Ministry of Education, Youth and Sports (MOEYS) adopted measures to address learning gaps, specifically by developing a condensed curriculum and a remedial education package (for grades 2 to 6) for mathematics and Khmer to support schools and teachers to organize catch-up learning programs. However, limited resources and teacher capacity hindered implementation. To supplement these government's efforts, child-focused nongovernment organization World Vision International in Cambodia (WVI-C) piloted a community-based catch-up project in August 2021 to support children's learning development. This project

mobilized community volunteers, including youths and parents and/or caregivers, and local authorities to establish and deliver joint catch-up classes for children in grades 2 and 3.

This essay presents insights into stakeholders' responses to the pandemic-induced learning disruption and recovery in Cambodia's schools after their reopening. Specifically, it explores how communities and parents served as key agents of support during school disruptions, especially for the most marginalized groups who are often unable to access learning opportunities. This essay discusses their efforts to maintain learning continuity and support for children's fundamental literacy, numeracy, and social-emotional skills—capabilities essential to successfully engage in the formal education system. These findings will help educators both to address the current COVID-19 recovery and build resilience to address future disruptions in education, especially for children from the poorest families. Our recommendations support Cambodia's Primary School Community Strategy and School-Based Management Policy, which aim to improve community ownership and children's learning outcomes. Sustaining and scaling these initiatives beyond pilot areas will require support from multiple stakeholders, including MOEYS.

7.2 Responses to COVID-19 Learning Disruption and Recovery Measures

Many schools were temporarily closed to reduce the spread of COVID-19. The shift to online learning challenged many students who lacked access to electronic devices or reliable internet connection. According to UNICEF (2021), school closures affected around 3 million students in Cambodia. On 15 July 2020, MOEYS formally endorsed the Cambodia Education Response Plan to the COVID-19 Pandemic (MOEYS 2020a), which established immediate actions and measures focusing on learning continuity for students with key instructions, guidelines, and directives disseminated nationwide. Major support activities included producing information, education, and communication and associated risk communication materials; building stronger and more resilient learning environments; providing basic hygiene supplies to schools; implementing school and student grants; managing the ID Poor cash transfer program, including links with the MOEYS scholarship program; preparing school meals for children from poor households; and preparing schools for safe reopening.

MOEYS, with the support of development partners, prioritized the establishment of comprehensive distance learning platforms.

New materials and modalities were continuously rolled out as school closures extended from the 2019/20 to the 2020/21 school year (MOEYS 2023a). Through the initial MOEYS directive on distance learning (MOEYS 2020b), a full list of learning platforms (both online and television) broadcast continuous programs. School directors and teachers were instructed to establish online learning groups with students and parents and/or caregivers, facilitate access to continuous learning programs, provide additional paper-based learning materials and/or textbooks, and conduct visits to monitor distance learning activities. Online learning platforms included the MOEYS e-learning website, Facebook page, YouTube channel, Krou Cambodia, and Komar Rien Koma Cheh, the ministry's official Facebook page for early grade learning. Continuous or distance learning programs were also broadcast on a new dedicated education TV channel (TVK2) and on radio. An evaluation of these policies found that students mostly used exercise worksheets and other paper-based learning materials for sharing and correcting (70%), followed by supplemental MOEYS educational orientation videos on social media (61%) and online learning modules prepared by many schools (46%).

Upon schools reopening, MOEYS implemented several catch-up initiatives to mitigate learning losses through a hybrid or blended learning approach that included face-to-face learning, online and distance learning, traditional learning (with worksheets), and self-study. Furthermore, the 2019/20 school year extended to December 2020, with the start of the new school year 2020/21 moved to 11 January 2021. MOEYS prioritized emphasized Khmer and math in the primary level and distributed "remedial Khmer packages" nationwide with the support of development partners. On three Thursdays per month for 2 hours, primary school teachers helped students use these learning resources. The bundle included a diagnostic tool for teachers to determine the learning loss of students and a final assessment to monitor learners' levels after the remedial classes.

These initiatives aimed to help students catch up on their missed education and address learning gaps caused by school closures during the COVID-19 pandemic. However, experiences globally indicate that all those involved still face a steep learning curve in developing, managing, and implementing these interventions. The Cambodia COVID-19 Joint Education Needs Assessment highlighted the challenges of implementing distance learning: unequal access to information and communication technology (ICT) at home and limited skills of teachers and parents and/or caregivers to use ICT (UNESCO 2021). Most teachers and school directors expressed concern that they did not have enough capacity to perform their job functions during school closures. While

these initiatives helped mitigate learning losses during school closures, there remains a gap in quality learning and in the coverage or reach of vulnerable students.

7.3 Learning Loss

In November 2021, as COVID-19 cases declined, MOEYS conducted the National Grade 6 Learning Assessment to evaluate students' pandemic-related learning losses during the school closures. The ministry's Education Quality Assurance Department tested more than 6,000 students in 230 schools across the country. The findings confirmed learning deficits, with the percentage of students lacking basic Khmer language proficiency increasing from 34% in 2016 to 45% (MOEYS 2022).

The WVI-C baseline assessment, carried out in February 2023, further highlighted this trend in learning losses. The Standard Test About Reading (STAR) was administered to evaluate grade 3 children's reading comprehension. According to the STAR assessment, 51.4% could read with comprehension by grade 3, 10.3% were beginning readers, and 38.4% were non-readers. It also revealed gender differences, with more girls achieving reading comprehension and fewer classified as non-readers (29%) compared to boys (48%).

A study by MOEYS (2023a) revealed that most children in primary school advanced to the next grade after schools reopened in January 2022. Despite support from their parents and/or caregivers and teachers, 26% of students struggled to catch up, and 78% reported falling behind in learning.

7.4 Roles of Communities and Parents
to Maintain Learning Continuity

The school closures due to pandemic measures disrupted learning. While various programs and policies were designed to help students catch up, their coverage and implementation were limited. Challenges included insufficient access to learning materials, limited access to devices for online learning, poor internet connectivity, and inadequate support from parents and/or caregivers. Research shows that participation by the community and parents can serve as a catalyst for uplifting children's learning and promoting their learning potential (Aref 2010).

Recognizing the essential support from parents and/or caregivers, WVI-C integrated community-based interventions in its education programming, promoting awareness and literacy activities at community

and household levels. However, parents and/or caregivers often were not able to provide support at home because of their own literacy limitations or resource constraints. WVI-C's COVID-19 Vulnerability Assessment Report (2021) found that 23% of parents and/or caregivers lacked confidence to help their children with home learning. Even those confident about supporting their children, 46.8% did not have time to support their children and 30% did not have relevant teaching materials.

To address urgent learning needs, WVI-C piloted the community-based Catch-Up Learning Project (CUP) to explore the roles of community members in supporting children affected by prolonged school closures to achieve foundational literacy skills which they should have mastered (WVI-C 2021). CUP has four key elements: First, an initial assessment of the literacy and numeracy levels of the target students to identify their needs, adapt the content of the catch-up sessions accordingly, and establish baselines for measuring their progress by the end of the project and assessing project effectiveness. Second, engagement with the village chief and the Commune Committee for Women and Children to recruit exemplary volunteer youth facilitators for a smooth selection process. The CUP facilitators underwent a 3-day in-person training on the syllabus and facilitation skills at the beginning of the project, followed by another 2-day training focused on the content of the upcoming sessions, especially numeracy, after 3 weeks of implementation. Weekly reflection meetings discussed challenges, lessons learned, and opportunities for improvement. Due to limited time for capacity building of volunteers, the facilitators were expected to do additional research using YouTube and the MOEYS textbooks to develop the lessons based on the provided syllabus. Third, catch-up learning sessions ran daily from Monday to Friday for 6 weeks per group of students. Last, an evaluation was conducted to measure of progress against the initial assessment. This evaluation also involved interviews with local stakeholders and five focus group discussions with parents, students, local authorities, and volunteers.

Building on World Vision's global approach to remedial education (WVI 2021), CUP was adapted to fit Cambodia's context and needs. The pilot targeted students in grades 2 and 3 based on global literature suggesting that younger students are more vulnerable to learning losses of foundational skills, specifically literacy, numeracy, and social-emotional skills, which are critical for future learning.

After a month and a half of implementation, around 75% of the students had improved their scores from the initial to the final assessment, with progress more marked in literacy (22% increase) than in numeracy (17%). In addition, the proportion of students rated *proficient* (scoring at least 60% for each subtest of the questionnaires)

rose by 8 percentage points in literacy and 13 points in numeracy. However, the initial assessment found that 5–6 months would be needed to implement a curriculum that addresses the significant learning gaps. This finding suggests that catch-up learning projects require extended time frames to effectively counter learning losses due to the pandemic.

Further, such a community-based mechanism offers benefits beyond pandemic recovery by providing a ready solution to address the needs of low-performing school children. In addition, community support for learning continuity may help build resilience against potential future short- or medium-term school closures caused by significant events such as annual floods.

The following three factors contributed to the effectiveness of community-based interventions like CUP in addressing learning losses: First, community ownership is a key driver for sustainability. Communities with greater shared ownership of their future, through learning, can participate in local development while also responding to global issues (UNESCO 2017). At the closing workshop of the community-based CUP, the village chiefs agreed to include the agenda in the Annual Community Review and Planning meeting and allocate some budget in the Commune Investment Plan to support continued interventions promoted in CUP. This engagement with the village chiefs and the Commune Committee unlocked several possibilities for strengthened implementation, such as through community mobilization from the start of the project.

Another important element of community ownership is the strong engagement of the volunteers. They pointed out that the community volunteer groups formed clear organizational structures with defined roles and responsibilities so they could participate in high-level meetings with commune councils and village chiefs. This enabled the volunteers to advocate for Commune Investment Plan funds to cover part of the project costs. Such additional funding will expand the coverage of interventions and ensure sustainable support for less advanced students beyond the current learning crisis.

Second, CUP proved cost-effective because the catch-up program required mainly volunteer incentives (about $5 per day), which could be sustained through community mobilization even after the pandemic, according to the dialogue with the parent and/or caregiver groups. Further, the program leveraged resources not only from WVI-C, but also from the community, including efforts to map out the existing resources such as meeting venue, youth volunteers, and other supplies for teaching and learning.

Third, CUP built resilience in the community. It not only provided capacity building among the community volunteers but also increased

the implementation capacity of the village chief, Commune Committee for Women and Children, and other local authorities by providing them with the necessary information to successfully implement the projects. This enhanced capacity positions communities to act and respond to future crises and disruptions.

Moving forward, the Government of Cambodia plans to expand CUP to all WVI-C's area programs in 34 districts in 10 provinces. Based on the results of the STAR assessment, field teams will work with school support committees and local authorities (Village Chief or Commune Committee for Women and Children) to implement this project for children at the non-reader and beginner levels to help them master foundational literacy skills so they can catch up with the lessons in grade 4. Furthermore, school directors and teachers can also use the STAR results to further improve their pedagogical methods.

Ongoing remedial learning and teaching should be offered to those students who are falling behind. Field teams will work with school directors and teachers to set up quarterly teacher–parent meetings to identify gaps and support roles. Teachers can arrange peer-to-peer support, additional worksheets and homework, and tutoring during break times. MOEYS has also endorsed the remedial class initiative of the Cambodian Consortium for Out-of-School Children, of which WVI-C is a member (MOEYS 2023b). This intervention will allow schools to arrange remedial classes for grades 2 to 6. Teachers will be offered additional incentives to run these remedial classes after their working hours.

Scaling up effective community-based practices requires support from the MOEYS and other education partners. First, MOEYS needs to coordinate with the Provincial Department of Education, District Department of Education, and the School Cluster Director. This engagement will enable the School Support Committee (which consists of the school director, local authorities, and community representatives) to provide additional support to community volunteers who are facilitating the CUP sessions. Such support can take the form of capacity building and a monitoring mechanism to track children's progress. Also, the support activities encompass recruiting volunteers, developing questionnaires for the assessments, designing the curriculum (following the initial assessment), and supervising, mentoring, and coaching volunteers to ensure the quality of teaching and learning. Minimum criteria for selecting community volunteers need to be established, as well as recommendations for capacity-building opportunities to run the program. Ideally, local education actors should certify the community volunteers when they have enough capacity. These measures contribute to the Primary School Community Strategy and School-Based

Management Policy, improving community ownership and learning outcomes of children.

Second, engaging involvement of the District Department of Education, School Cluster Director, and local authorities in CUP creates advocacy opportunities for volunteer groups to secure sustained support for interventions. This could make space in the policy dialogue among stakeholders to include community-based initiatives like CUP in the Commune Investment Plan, hence making the interventions sustainable.

Third, resources should be allocated for capacity building of teachers on remedial education. More importantly, the monitoring system and activities at each school should be strengthened to track the challenges, progress, and support needed.

7.5 Conclusion

In conclusion, the COVID-19 pandemic had tremendous impacts on the education sector in Cambodia and around the world. School closures and subsequent distance learning affected children's physical and mental health, nutrition, safety, and learning. The Government of Cambodia and development partners implemented response measures to mitigate the potential negative impacts on the economy and lives of citizens. However, the prolonged school closures resulted in significant learning losses for children. With limited available support from teachers, learning continuity relied mainly on parents and/or caregivers and the community. It is essential that parents and the community understand their roles in solutions to mitigate the learning gap of children such as CUP, online learning, and other MOEYS platforms. School directors, teachers, and local authorities serve as catalyst for sustaining these solutions at the grassroots level. Hence, addressing learning gaps unquestionably requires support from multiple stakeholders, especially MOEYS, to mobilize all available resources to address the urgency of this matter. These recommendations will strengthen the education system's resilience to cope with the learning losses during the pandemic as well as the impact of future shocks and disruptions.

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8

The Escuela Nueva Learning Circles: Learning in Emergency Situations

Vicky Colbert and Eduardo Velez Bustillo

8.1 Introduction

The coronavirus disease (COVID-19) pandemic forced school closures, disrupting learning worldwide, with particularly severe impacts on children from low-income families. Experts calculate that more than 1.5 billion students were affected at the peak of the pandemic (UNESCO 2020) and that learning losses could cost close to $15 trillion in lifetime earnings (Psacharopoulos et al. 2021). Research shows that learning losses average a half year's worth of learning (Patrinos, Vegas, and Carter-Rau 2023) and, more specifically, that a 20-week closure would reduce learning by 0.20 standard deviation, equivalent to almost 1 year of schooling (Patrinos 2023). Many students, especially in low-income and middle-income countries, experienced longer closures.

This situation should have been predictable because education systems are not equipped with the elements and structures needed to ensure learning outside classrooms. Although there has been progress in developing new technologies, none can replace a teacher's ability to teach. Information technology complements the learning process in basic education, but it cannot substitute for the role of the teacher.

The pandemic thus showed the importance of building resilient education systems that are prepared not only for future pandemics but also for disruptions from natural hazards and events, such as earthquakes, floods, monsoons, or conflict. Most students in households with incomes under the poverty line in the developing world—roughly the bottom 80% in low-income countries and the bottom 50% in

middle-income countries—lack the basic conditions for home learning (de Hoyos and Saavedra 2021). They do not have access to the internet, and, often, their parents or guardians do not have the necessary schooling or time to support their learning. Closing that digital divide to provide connectivity to poor households is essential, but insufficient alone. Learning continuity also requires the presence of an adult as a facilitator—whether a parent, guardian, instructor, or community worker—to support student learning during school closures. Rebuilding an education system will require investing in models to provide disadvantaged students the minimum conditions to learn at home. The Escuela Nueva Learning Circles (ENLC), a program operating in Colombia for 2 decades, offers one such solution. This essay describes its characteristics and potential for making education systems more resilient.

8.2 Escuela Nueva Learning Circles

The ENLC program is an adaptation of the Escuela Nueva child-centered pedagogical model to provide high-quality education to out-of-school children, children displaced by violence, and hard-to-reach children in vulnerable social situations due to poverty, health and natural emergencies, or political conflict. Children officially enroll in a "mother school" but study in "learning circles" of groups of up to 15 students with a tutor who facilitates learning by using personalized learning spaces like community centers, local churches, or homes to ease children's transition from the street to school and prepare them to transfer to a regular school.

This initiative, developed by the Colombian nongovernment organization Fundación Escuela Nueva (FEN), took elements of Escuela Activa Urbana (EAU), a previous adaptation of the Escuela Nueva model for urban settings. ENLC has successfully accelerated the reintegration of out-of-school children displaced by violence into the educational system, understood and supported their unique psychosocial needs and improved their learning outcomes. FEN first developed and piloted EAU in 1987 with support from the Interamerican Foundation, initially in Bogotá and Medellín and later in Manizales in 2007. This urban adaptation of Escuela Nueva became FEN's founding project. Building on this experience, FEN piloted the ENLC program in 2001 in Soacha, Colombia, initially for internally displaced populations. The program has since expanded to address a major challenge in Colombia's education system: the large influx of migrant children from Venezuela.

8.3 The ENLC Model

This ENLC model is integrated into and recognized by the Ministry of Education, rather than establishing a parallel school system. The ENLC program is officially linked to the school system through a shared regular curriculum, academic calendars, grading systems, and extracurricular programs. Instructors receive training in both the Escuela Nueva model and leadership in the circles, gaining practical teaching experience by interacting with their peers in the training sessions.

ENLC innovates on the proven Escuela Nueva pedagogical model to meet the distinctive needs of vulnerable children. It also provides basic skills, counseling, and psychosocial support to children and families. An underlying principle of the model is that education can be life-saving and life-sustaining by developing children's basic skills. Community spaces offer a safe, caring, and protective environment where personalized and extra socio-affective support restores and strengthens children's self-esteem, enhances their social and life skills, and creates a joyful learning experience. The program's approach aims to improve resilience, both resistance and renewal.

8.3.1 Pedagogical Principles

The essence of the innovation is to improve the quality of teaching and learning (FEN 2011; Madhavan 2015; Colbert and Arboleda 2016). Inspired by the pedagogical principles of thinkers like Dewey, Montessori, and Piaget, ENLC transforms places of learning (classrooms, churches, or adapted family rooms) into active, participatory, and collaborative learning environments. It converts traditional passive, teacher-centered environments typical of rural and low-income schools into student-centered participatory learning experiences. Instead of the core of education practice, which is often rigid and teacher centered, Escuela Nueva—and subsequently ENLC—employs a flexible, child-centered pedagogical approach that encourages student collaboration and voice.

Following the original Escuela Nueva model, ENLC develops six key areas at the student level: (i) active and reflective learning, (ii) analytical and applied skills, (iii) strong self-esteem, (iv) attitudes supportive of cooperation and solidarity, (v) positive attitudes toward civic and democratic values, and (vi) a good knowledge of the curriculum areas. Thus, the ENLC program promotes students' ability to apply knowledge to new situations and develop critical thinking skills. Among teachers (instructors or facilitators), ENLC fosters a shift toward viewing the role of teachers as guides and facilitators. The program provides interactive educational materials that build relevant knowledge and practical

skills within a stable learning environment conducive to developing emotional, social, and cognitive skills. Table 8.1 presents a summary of the differences between an Escuela Nueva-inspired approach and a traditional one.

Table 8.1: Escuela Nueva Versus Conventional School

Features	Conventional School	Escuela Nueva
Teaching	Frontal transmission	Facilitating child-centered learning
Learning	Rote memorization	Reflexive-comprehensive
Student involvement	Passive	Active
Classroom organization	Sitting in rows	Small groups
Content	Information overload	Process oriented, linked to children's everyday life
Books and materials	Scarce	Plenty learning guides
Learning setting	Classroom only	Classroom and school environment, community
School–community	Weak link	Strong link
Calendar–schedules	Rigid	Flexible
Evaluation	Memory-based summative and occasional	Formative ongoing qualitative and competency-based

Source: Colbert and Arboleda (2016, p. 302).

The ENLC curriculum is aligned with the national standards and associated competencies and is delivered through learning guides for students. These learning guides follow the methodological structure of the Escuela Nueva model and are a hybrid of conventional textbooks, activity workbooks, and teacher or facilitator guides. They promote collective construction of knowledge by integrating content with cooperative learning principles and by encouraging dialogue and interaction among students and with teachers or facilitators, while maintaining active, child-centered learning. Their modular structure allows for flexibility and different learning rhythms among students. They facilitate individual, pair, and group activities and incorporate many child-to-child activities. Students assimilate content through these interactions, rather than relying solely on traditional teacher or facilitator instruction. While delivering the national framework, the learning guides are open-ended so that teachers or facilitators can

adapt content to local contexts, as necessary, and encourage practical application of material learned in community life (Mogollon and Mogollon 2011).

Teamwork and cooperation form the cornerstone of the Escuela Nueva model, serving as the key pedagogical methodology to produce individual and collective outcomes (Johnson and Johnson 1994). This cooperative learning approach draws from psychology, anthropology, sociology, politics, and economics, translating the principles into pedagogical practices that integrate the conditions and components of cooperation to promote participation in the classroom and a pedagogic approach centered on the learner. The Escuela Nueva model and ENLC exemplify how cooperation cultivates achievement, esteem, and civic conduct, while shifting the conversation around effective teaching and learning, and the role of education in the community and society. The learning guides reinforce the terms *we* and *our*, creating a collective mindset that implies that activities can be completed effectively only through collective effort. They also explicitly integrate the principles of cooperation through instructions such as "we express our opinions" and "we make sure to let everyone participate." In this way, students are subtly, but surely, guided toward constantly cooperating with each other (Colbert and Arboleda 2016).

The learning guides structure learning as a significant social activity, directing students to discuss and debate ideas as they engage in accommodation and assimilation of concepts. Through consistent dialogue, students share and challenge different interpretations of concepts, consolidating or changing their initial understanding. Through this process, they strengthen their conceptual notions and ability to apply concepts in unfamiliar or challenging contexts, a significant element of learning and understanding. They also build confidence in communicating effectively and efficiently, persuading others to accept opinions, and offering empathy and openness to other perspectives or approaches.

The learning guides also promote participation from parents and families by requiring students to "include your family in this process." The program seeks to increase parental involvement in their children's education and in solving their children's problems (Madhavan 2015; Colbert and Arboleda 2016). Often, the activities require active engagement from family members, asking students to complete activities with them, again creating a sense that learning occurs not in isolation but through interaction and engagement with others. The learning guides thus leverage the knowledge and skills of families to enhance learning, creating a learning community that extends beyond school walls. Students share and reuse these guides across years. Embedded even within this is the notion of interdependence, as students are expected to

maintain the materials in good condition (Mogollon and Mogollon 2011; Colbert and Arboleda 2016).

Finally, promotion within ENLC redefines the concept of automatic promotion to the next school grade. In general, ENLC promotes flexible promotion, based upon modular learning as opposed to rigid grade promotion. It allows children to learn at their own pace and fill educational gaps with a focus on cooperative learning that promotes dialogue, interaction, and social skills. It uses a self-monitoring mechanism with students keeping track of their own attendance. Teachers or facilitators evaluate students' learning using a progress control instrument where they give feedback between activities. This strengthens formative evaluation throughout the process to ensure learning (Mogollon and Mogollon 2011; Colbert and Arboleda 2016).

8.4 Evidence of Impact

Colombia's experience with ENLC demonstrates the program's potential to strengthen education service delivery. ENLC has gained support among practitioners and national authorities because it is a cost-effective, flexible, adaptable, and replicable systemic approach. Following the Escuela Nueva model, ENLC helps improve the adaptability of the education system to face challenges like school closures and displaced populations. Its ability to create unique connections between the learning circles and local "mother schools" provides displaced or marginalized children a chance for inclusion and continuity on the education ladder.

Students' improvement under the ENLC model proved significant in its first implementation in the early 2000s. At the beginning of the academic year, 47.5% of ENLC students achieved passing grades in language compared to 71.3% in the control group. By the end of the academic year, ENLC students outperformed the control groups (83.6% versus 82.7%). Mathematics scores showed even greater improvement, with ENLC children exceeding the national average. In addition, the model achieved full enrollment and boosted children's self-esteem by 18.5% (FEN 2005).

During the pilot and first-year program, all ENLC students moved to regular schools. An evaluation after the pilot and the first year of the expansion revealed that the program boosted school enrollment and enhanced schools' internal efficiency by increasing retention and completion rates, while reducing youth vagrancy.[1] It provided

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[1]   No randomized control trials were used. The control groups consisted of classrooms of public schools with traditional teaching and learning methods that were relatively close to where ENLC operated.

protection to displaced, at-risk youths even during school closures. Thus, the program even reached children who are outside the education system due to displacement, poverty, or school closure. It does this by providing an educational strategy that is adaptable to student mobility, relevant, interactive, and flexible in its learning process and enrollment requirements. Evidence further shows that the program improved the quality of education, as measured by improved student performance in standardized tests in Spanish and math. It improved the socio-emotional skills of students, such as empathy, cooperation, and emotion management, and increased citizenship and peaceful coexistence among youths facing educational and social challenges. Last, the program successfully raised the interest and participation of parents and communities in students' education.

8.4.1 New Challenges and Opportunities for Impact

The huge influx of migrants from Venezuela in the past decade presented both an opportunity and a challenge for ENLC as an alternative model to delivering education. By the end of the 2010s, more than 400,000 school-aged migrant children were living in Colombia, with only 10% formally enrolled in school (World Bank 2018). The regular school system struggled to meet the needs of these migrant children as conventional methods—assuming that children learn at the same pace and have a similar knowledge base, using frontal, teacher-centered methods with whole-class instruction—made it extremely difficult for these students to succeed.

In 2019, the United Nations Children's Fund (UNICEF) and FEN, with support from the World Bank, funded the implementation of the Escuela Nueva Learning Circles program in six Colombian cities to serve the educational needs of migrant children. A central lesson from the program's implementation is that the effectiveness of the learning circles depends on the quality of support from the technical and management teams of the education secretariats in each *departamento*. These teams are expected to identify, characterize, and engage migrant and out-of-school children, and to coordinate with the receiving formal schools. The teams were effective in inviting and linking children to the program and ensuring a smooth eventual transition of these children to regular schools.

During the pandemic-related quarantine and school closures, the program was adapted to support low-income students in cities with internally displaced populations and, more recently, migrant children from Venezuela without adequate internet access. The program used cell phones to deliver learning materials, such as guides, workbooks,

and supplies, to each student and to provide written guidelines, physically and via WhatsApp or text message, to parents or other adults responsible for the children about how tutors and other facilitators will support children through phone calls or virtual means. The progress of the program during the pandemic was monitored in different ways—through periodic individual phone calls, WhatsApp groups and other means of interaction among students and instructors, photos, videos, and audio messages from instructors, children, and parents. As of this writing, no results about achievement have been published.

There will be other serious challenges to the regular school systems in the future—with more dire consequences for children of disadvantaged groups because of poverty and lack of access to public services. The ENLC program presents an alternative learning model that could help bridge those gaps. Integrating the ENLC model into mainstream school systems could enhance system resilience, especially for those children most in need.

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9

Learning Through Emergencies: Using Mobile Phones to Deliver Quality Education in the Philippines

Amanda Beatty, Karisha Anne Cruz, Janica Magat, and Rene Marlon Panti

9.1 Introduction

Primary and secondary schools in the Philippines, serving over 27 million students, closed in March 2020 due to the global pandemic. Most remained closed for 2 years—one of the longest school closures in the world. These closures took place in a country accustomed to school disruptions due to natural disasters. The Philippines ranked first among 193 countries in the 2022 disaster risk global index (Bündnis Entwicklung Hilft 2022). Situated in the so-called Pacific Ring of Fire, the country is more susceptible to earthquakes and volcanic eruptions, while its geography also leaves it vulnerable to sea-level rise, floods, droughts, and tsunamis (David et al. 2018). Furthermore, the country averages about 20 tropical cyclones per year (Dela Cruz Santos 2021). Thus not surprisingly, about 2 years into the pandemic in December 2021, a devastating super typhoon (Typhoon Rai) ravaged the country, affecting 15 million learners, destroying almost 8,000 classrooms, and further inhibiting students' access to learning (Bautista 2021).

While the Philippines Department of Education (DepEd) deployed learning continuity and resilience interventions during natural hazards before 2020, its standard response was to suspend classes, especially when classrooms served as evacuation centers, and/or to extend the school term. As part of its pandemic response in 2020, DepEd launched the Basic Education Learning Continuity Program, which offered print, digital,

television-based, radio-based, and online learning options. However, many students still faced challenges accessing and/or learning via these options due to connectivity issues and/or limited contact with educators. For example, we learned through our data collection for this study that over half of caregivers reported that their child's teacher had not once contacted them during the last quarter of the 2020/21 school year.

Because existing remote learning options failed to adequately serve many children, Innovations for Poverty Action (IPA) Philippines and DepEd partnered with Youth Impact in August 2021 to pilot using mobile phones to support distance learning. National statistics showed that over 90% of Filipino households had access to a mobile phone, making phone calls a near universal medium for instruction, if successful (Philippine Statistics Authority 2021). The unexpected tragedy of Typhoon Rai in December 2021 further emphasized the need for rapidly deployable instruction that could reach children when physical schools were not accessible. This additional emergency provided an opportunity to test the effectiveness of reaching students by mobile phone in an emergency setting beyond the pandemic.

9.1.1 Remote Learning by Phone in the Philippines: mEducation

In response to distance learning challenges faced by millions of children in 2020, Youth Impact, a nongovernment organization headquartered in Botswana began designing a phone-based adaptation of Teaching at the Right Level (TaRL), a proven approach to teaching foundational literacy and numeracy that tailors lessons to each child's learning pace and ability. This mobile education program, called ConnectEd, was tested using a randomized trial and showed that learning improved by 0.12 standard deviations (Angrist, Berman, and Matsheng 2022). The positive impact in Botswana prompted a coalition of nongovernment organizations, governments, multilateral organizations, and researchers to test and adapt ConnectEd in five additional countries from 2020 to 2022. Results from the five-country study are published in Angrist et al. (2023).

IPA and DepEd adapted ConnectEd for the Philippines, naming it mEducation. The 8-week program provided grade 3 and 4 students with math problems delivered via text message along with a 20-minute phone tutorial session (Figure 9.1). Lessons on basic operations (addition, subtraction, multiplication, division) were tailored to each student's previous knowledge and performance. mEducation was highly integrated with government systems with all tutoring delivered by licensed teachers working within existing structures. Tutors included both classroom teachers instructing their assigned students and teacher aides, qualified applicants awaiting placement in DepEd schools

who were recommended as tutors by DepEd school division offices. IPA trained both groups and worked with DepEd to ensure that the mEducation exercises were aligned with the curriculum expectations for grades 3 and 4, further ensuring government integration and take-up. IPA and DepEd began testing mEducation in August 2021.

Figure 9.1: mEducation Includes Weekly Text Messages with Mathematics Problems and Phone Tutorial Sessions

Source: Authors.
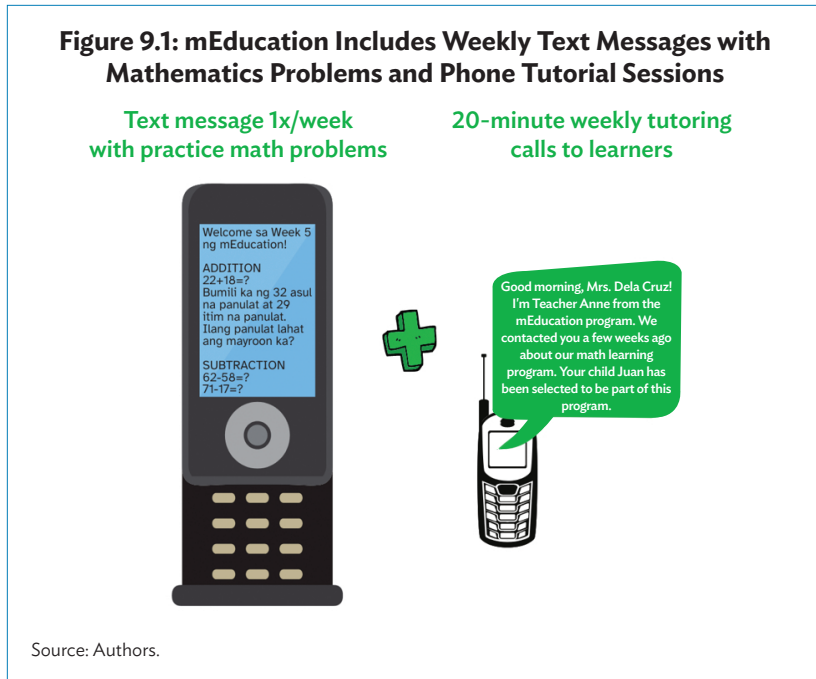
9.1.2 Study Design

IPA, DepEd, and Youth Impact launched a randomized trial of mEducation across the country's three major island groups—Luzon, Visayas, and Mindanao—selecting one region from each (Region 4-B, Region 6, and Region 9 out of total 17). These regions included several provinces most vulnerable to typhoons and other natural disasters in the country, allowing IPA and DepEd to test mEducation in the event of an emergency and to test it in underserved areas with limited internet connectivity.

During implementation, the Philippines was struck by Typhoon Rai, the country's second most costly typhoon in history in terms of physical damage. Some implementation sites were among the most impacted regions, where the government declared a 1-year state of calamity (OCHA 2022).

IPA worked with DepEd to collect phone numbers of households from 33 schools across these regions, enrolling 2,530 eligible students in grades 3 and 4 in the program in October 2021 for 8 weeks. Students were randomly allocated to three groups. The first group received weekly text messages with math problems and messages encouraging caregivers to support children with their mEducation math problems along with other education reminders, such as the importance of continued school attendance and information about the return to schooling. The second group received the text messages sent to the first group along with phone tutoring. The third was a control group. Due to DepEd's interest in directly delivering mEducation, DepEd and IPA implemented a second trial in April 2022 across 77 schools (outside typhoon-affected areas) with DepEd teachers carrying out the phone tutoring.

9.2 Overcoming Key Challenges

IPA and DepEd encountered numerous challenges over the course of mEducation implementation. The following describes measures implementers took to address these challenges.

9.2.1 Building on DepEd's Strengths and Establishing Processes to Support Coordination with DepEd

Throughout the pandemic, DepEd prioritized learning continuity while teachers reported feeling overwhelmed by having to spend more working hours than before on module preparation and other administrative tasks. Recognizing these challenges, IPA responded by supporting DepEd in mEducation implementation, conducting virtual orientations across all governance levels (national, regional, school division, and schools) to introduce the mEducation program and discuss the implementation plan. IPA also used orientations for teachers to raise concerns about remote instruction and to lead training sessions with teacher aides. Further, IPA set up real-time monitoring systems to track tutors' progress in completing weekly phone call tutorials and to nudge tutors who were behind schedule. Teacher aides also contacted schools as concerns arose, especially shortly after Typhoon Rai.

9.2.2 Ensuring Household Access to Reliable Mobile Networks

mEducation only requires basic cellular phones. While most households had mobile phones and working networks, remote areas faced weaker mobile signals. IPA addressed this by enabling a flexible schedule that accommodated the availability of teachers, parents, and students and

allowed them time to prepare to receive the phone calls. In areas with unreliable signal, parents and students identified spots in their house or relocated to spots in their neighborhood with the strongest signal prior to the tutorial sessions. Parents were highly motivated to gain access to education for their children. Overall, mEducation's weekly reach rates averaged over 80%.

9.2.3 Completing an Endline Assessment After the Emergency

The most significant challenge IPA and DepEd faced related to the Typhoon Rai response was conducting phone-based assessments, including the endline survey. IPA and DepEd were able to contact households due to high mobile phone access, which enabled a rapid, nimble response relative to in-person alternatives. Moreover, mEducation had a stable monitoring system. Because IPA and DepEd stored up-to-date contact information for every student and teacher aide, teacher aides were in weekly contact with students. Additionally because IPA and DepEd used survey software to track call records and student progress in real time, they could easily identify teachers and students who were affected by the typhoon and adapt to the circumstances.

9.3 Outcomes

9.3.1 mEducation Was Highly Successful Across All Areas in Which IPA and DepEd Were Implemented

Overall, students who received text messages plus tutoring showed learning gains of 0.45 standard deviations (statistically significant at the 1% level). Even students who received simple text messages alone learned; they gained 0.09 standard deviations (statistically significant at 10% level). Figure 9.2 shows the share of children who at endline had mastered each basic operation for the two intervention arms compared to the control. For example, 46% of students who received text messages and phone tutoring learned multiplication compared to 28% in the control group. Even simple text messages alone improved multiplication mastery by 5 percentage points over the control group. Note that the treatment and control groups were balanced on learning levels and other key demographics at baseline.

Figure 9.2: mEducation Was Highly Effective at Improving Learning Across All Operations

Percent of students who had mastered skill at endline

■ No program   ■ Text only   ■ Text + call

Source: Authors.
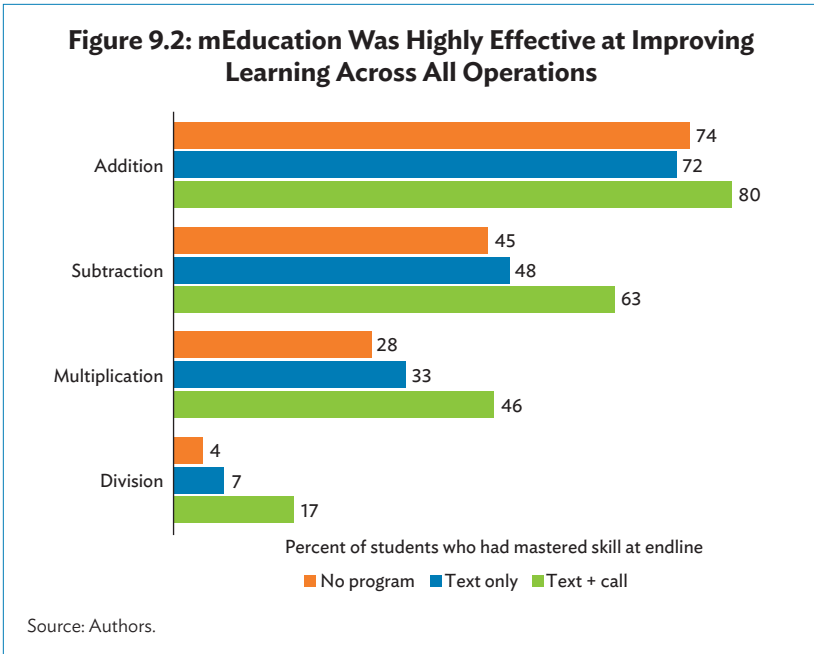
9.3.2 mEducation Was Equally Effective Across Different Types of Teachers

The effectiveness of mEducation persisted irrespective of whether it was implemented by DepEd teacher aides (licensed teachers waiting placement) or classroom teachers. As shown in Figure 9.3, there is at most a 2-percentage-point difference in outcomes across different types of tutors. The figure shows the share of children who had mastered an operation at endline. For example, 44% of learners taught by DepEd classroom teachers mastered multiplication, compared to 45% of learners taught by DepEd teacher aides.

9.3.3 mEducation is Extremely Cost-Effective

Mobile phones, the primary instructional tool used for mEducation, are already in students' homes. Thus primary cost drivers for mEducation are limited to content delivery and connecting with families, such as tutor training, lesson preparation, tutoring time (for scheduling and making calls), mobile phone airtime, and staff time for supervision and management. If mEducation utilizes teachers who are not in classrooms during emergency situations but are being paid by DepEd regardless,

Figure 9.3: DepEd Teacher Aides and Classroom Teachers Proved Equally Effective in Teaching Children Through mEducation

Skill	Classroom teachers	Teacher aides
Addition	81	80
Subtraction	64	62
Multiplication	44	45
Division	15	17

Percent of students who've mastered skill at endline

■ Classroom teachers ■ Teacher aides
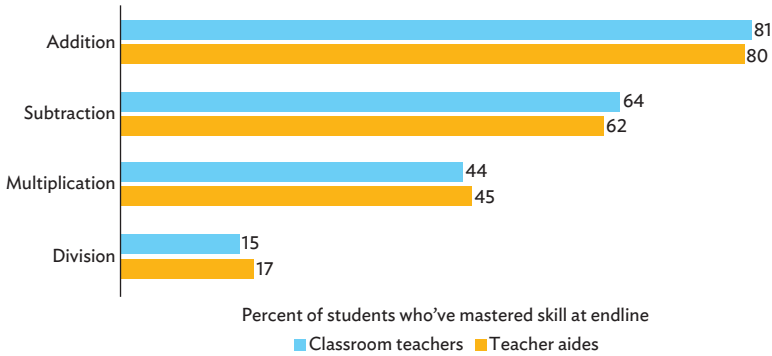
Source: Authors.

Figure 9.4: mEducation Is Among the Most Effective Remedial and Edtech Interventions

Intervention	LAYS per $100
Technology-aided after-school instruction	0.2
Teacher training on targeted instruction + improved mgmt	0.3
Afterschool remediation, scripted lessons, teacher coaching	0.5
Teacher training on targeted instruction alone	0.6
Teaching at the Right Level (gvmt led)	0.9
Computer-assisted learning	1.4
30-day reading competition	1.5
Classroom observation + coaching	2.4
mEducation	3.1
Remedial pull-out instruction	3.8
Structured pedagogy Tusome, PRIMR)	4.9

LAYS per $100

Source: Data on LAYS and cost (other than mEducation) from Angrist et al. (2020, Fig. 5).

the main marginal cost is airtime. In the mEducation IPA study, costs per student for the duration of the program averaged $18. (Note that costs were for program delivery only.)

To put these cost numbers in perspective, we use Learning-Adjusted Years of Schooling (LAYS), which is a calculation of how many

high-quality years of schooling an intervention is equivalent to in a given context. Figure 9.4 shows a comparison of the LAYS per $100 for edtech and pedagogy interventions that demonstrated an impact. (The vast majority do not.) mEducation produced 3.1 LAYS per $100, ranking among the top five most cost-effective interventions for this category.

9.4 Lessons Learned

We highlight key lessons for implementers and policymakers to consider for education in emergency settings.

9.4.1 Systems Vulnerable to Emergencies Should Consider Adopting Mobile Education Options as Part of an Emergency Preparedness Tool Kit

In many areas in the Philippines, school closures can be prolonged not only due to emergency situations but because of their aftermath. For example, 63% of the country's evacuation centers are schools that house displaced and vulnerable citizens during emergencies for several days or even weeks (Lacerna 2023). Disasters further affect the quality of learning as it is difficult to predict for how long school buildings will be used as temporary shelter. Especially in contexts like the Philippines that are prone to natural disasters that disrupt schooling yearly (or even more frequently), systems need to be prepared to shift to alternatives to in-person instruction. mEducation offers this flexibility as long as systems prepare by collecting phone numbers of learners and teachers and teachers have curriculum materials ready for use in emergencies. DepEd's successful implementation of mEducation with government teachers further demonstrates its potential for scale and system-wide adoption.

9.4.2 Robust Monitoring and Communication Systems Are Essential to an Effective Emergency Response in Education

When implementing mEducation, IPA's data collection platform (SurveyCTO) enabled the program to manage calls and track household information and results. For example, after each tutoring session, tutors entered information about how the child performed in numeracy. This allowed IPA to track weekly learner progress and evaluate the content and the pace of lessons. After Typhoon Rai, IPA was also able to pinpoint affected households or tutors based on lack of responses to calls. IPA was able to quickly check in with teacher aides to determine

the situation on the ground. Such simple systems are essential to education continuity during emergencies and could be easily integrated into DepEd's response tool kit. Indeed, this study showed that DepEd teachers effectively carried out phone tutoring sessions. With proper planning and coordination, mEducation can serve households affected by these frequent disruptions and can supplement DepEd's strategies on disaster response to mitigate learning loss.

9.4.3 Creating a Culture of Continuous Learning Enables Systems to Adapt in Emergencies

While the mEducation evaluation was one of DepEd's first randomized controlled trials, IPA and Youth Impact have since worked with DepEd for several years to adapt and evaluate it. This partnership has materialized into formalized agreements with DepEd Central and Field Offices to generate evidence that can inform DepEd's policies. This agreement demonstrates an orientation to improve emergency response for learning.

9.4.4 Way Forward: Multiple Avenues for mEducation Expansion in the Philippines

mEducation's simple but effective and low-cost approach allows it to be easily tailored to align with DepEd's goals and learners' needs. IPA is working closely with DepEd offices at the national and regional levels to determine best pathways to scale, for example through national programs that focus on remediation and math tutoring, with the goal of adopting and integrating mEducation into programming focused on students in most need of learning support. Here we highlight three of the most promising options for scale and adoption. First, as mentioned earlier, mEducation could be integrated into the country's education in emergency preparedness plans. It can be deployed within days as long as a system is prepared with up-to-date contact information for students and teachers and has staff trained on the curriculum. Assembling such a database in emergency-prone areas and training teachers on mEducation principles can be a building block for strengthening system resilience. Second, mEducation's focus on math fundamentals allows it to provide one-on-one support to struggling learners, including children in hard-to-reach areas and/or with diverse language needs. This is done by using the country's wide mobile network coverage and matching learners with tutors who speak their primary language. Finally, mEducation can be utilized for children who are learning remotely or partially remotely (i.e., blended learning, such as through DepEd's Alternative Learning System).

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10

Digitally Enabled Learning Teams: Community, Technology, and Schools Teaming Up

Urvashi Sahni

Khushboo is a Dalit woman, 28 years of age, living in a low-income neighborhood with her family in Lucknow, India. She works in DiDi's, a local nongovernment organization providing sustainable livelihoods for women by selling catering services. Like everyone else, she was locked down during the early months of the coronavirus disease (COVID-19) pandemic. DiDi's scaled down operations greatly, schools were shut, the streets were nearly empty, and everyone was in their homes. Khushboo has six younger siblings, five of whom are school-age. They are all students at Prerna, the school she graduated from. A first-generation high school graduate, Khushboo has a master's degree in women's studies. During the pandemic, she saw her younger siblings, mostly girls, closed off from their studies. Month after month, schools remained closed and children were losing out on their learning. Khushboo got her siblings together on their terrace one day and asked them to bring their schoolbooks. She began teaching them for an hour every day.

A few days later the neighbor's children also joined. Khushboo felt she needed more guidance as the children were of varying ages, some in grades 7 and 8, all students at her old school. She called up the principal of her school, Rakhee, on her mobile phone and asked for help. Rakhee was delighted to connect and put Khushboo in touch with the classroom teachers who sent her learning materials by phone, along with assignments for the students. Rakhee asked Khushboo to facilitate her students' learning: to help them join online classes, get them to do the assignments, and send pictures back digitally, all on her smartphone. She could call the teachers and seek help if she had trouble with any of the materials. Khushboo got to work.

Her student group grew to 25 girls, none of whom had access to a mobile phone or any other digital device. There was normally one phone in the family, which the father used. She facilitated their learning for 4hours each day on her terrace. She did all this as a volunteer. In this way, Khushboo teamed up with a teacher using her mobile phone and kept 25 girls learning until schools resumed. She says she felt very empowered too: "My dream was to be a teacher, but I couldn't pursue my dream as I had the responsibility of taking care of my family. This made me feel so good!"

The pandemic disrupted education for all children across the globe, affecting nearly 1.6 billion learners in more than 190 countries and areas. The sudden closures of learning institutions affected over 100 million teachers and school personnel (UNESCO 2021). However, the impact was especially severe in countries like India, marked by deep inequalities of class, gender, and region. Whereas children from affluent families and well-resourced private schools adapted more resiliently to the disruption by using digital technologies, most children in India lacked access to these resources. The 2017-18 National Sample Survey reported that only 23.8%of Indian households had internet access (Kumar 2020). Young people's access was even more limited, with a 2020news report stating only 12.5%of students had access to the internet (Mukhopadhyay 2020). The figures were even lower for girls.

The disruption demanded highly creative and innovative solutions to maintain learning in disadvantaged communities. Khushboo's initiative and generous response, a digitally enabled community-based solution, inspired the formation of the Digital Saathi (Digital Companion) program by our organization, the Study Hall Educational Foundation (SHEF). SHEF runs four Pre-K to 12 schools, a college, and 148 community-based learning centers. It also partners with over 800 schools to train their teachers in critical feminist pedagogy. Since 1986, SHEF has impacted 5 million students—most of them girls from very marginalized communities—100,000 teachers, and 20 million community members. Our vision is to educate everyone for gender equality, social justice, personal flourishing, and active democratic citizenship. The Digital Saathi program enabled hundreds of students, most of them girls, to access education. Its success led us to continue even after schools reopened, demonstrating the power of technology-enabled, geographically distributed learning teams consisting of community volunteers and/or workers and schoolteachers to bridge geographical and skill barriers.

10.1 The Digital Saathi Program

SHEF directly works with 8,350 students in rural and low-income urban settings. During the pandemic, we found that half of our students, most of them girls, had no access to smartphones or the internet. Some households had no smartphone or, even when they did, girls had limited access. Mostly the parents (usually the father) were using it and took it to work all day, or other members in large families who were all sharing one phone laid claim—and girls came last. Parents who owned a phone and were willing to share it with their daughters often were illiterate and could provide little support.

At a time when we were struggling to connect with our students during the pandemic, Khushboo's initiative gave rise to our program. The school principals identified students meeting the following criteria: girls who had no access to a smartphone or the internet and who lived close to at least four other girls also without access. They then found a senior student (high school and at least 14 years of age) or preferably a school alumna living in that neighborhood and willing to facilitate the learning of a group of at least four girls in her neighborhood.

The school formed a library or bank of smartphones, equipped with data and the required learning apps, such as WhatsApp and Zoom. The selected volunteers were then trained in COVID-19 safety measures, basic facilitation skills, record keeping of attendance and assignments, and use of the apps. The volunteers and, in the case of minors, their parents had to deposit a small amount ₹200 ($2.50) as a security deposit, to be refunded when they returned the device. The volunteers or Digital Saathis were teamed up with one teacher from the school, who helped her use the materials and coached her, if necessary. The Digital Saathi would communicate daily by phone with her mentor teacher, who was included in her students' WhatsApp group. She would send videos and pictures of her class, sign her group in for the live Zoom classes with the teacher, help students with their assignments, and return the assignments to the teacher. The mentor teacher would review the program and the students' progress each month, also meeting the Digital Saathi in person once a month if possible.

Our community-based learning centers called Gyan Setu provided laptops to our local teachers, who teamed up with more skilled and experienced teachers in Lucknow to receive continuous mentoring and coaching in domain knowledge and pedagogy. The teachers were also offered video lessons and other teaching resources so they could upskill and give their students suitable content.

All our programs and schools drew on the Digital Saathis, enabling us to reach out to over 1,000 girls with 54 devices. These girls would

have otherwise been denied an education throughout the pandemic. Attendance at the Digital Saathi groups was maintained at 80%. As there was a lack of connectivity in some areas, we had to work only in areas where connectivity existed. Parental attitudes also posed challenges for some of our Digital Saathis. Some parents of the volunteers needed persuading as they were reluctant to have groups of children in their homes, or even outdoors, during the crisis.

10.2 Program Impact

Through the Digital Saathi program, more than 1,000 children from the most vulnerable communities were able to continue their education throughout the pandemic-induced lockdown. Teachers too could maintain contact to ensure the safety and well-being of students and their families during the crisis. Particularly for girls, this continued contact allowed them to stay up-to-date with their studies during the lockdown and facilitated their timely return to schools upon their reopening. Students have expressed their gratitude and enthusiasm for the opportunity to continue studying. Teachers reported that the program has empowered the Digital Saathis on two fronts. First, they are viewed in their communities as young leaders who teach younger students and act as liaisons between students and teachers. And second, they improved their own digital literacy significantly, learning to navigate platforms like Zoom for their online classes and submit assignments digitally. Additionally, the program initially identified 120 adolescent girls to provide them with digital literacy training through the Gyan Setu. Because of its success, the Gyan Setu's Digital Literacy Program continues to be in high demand and has become a facet of the project's regular activities, even beyond the COVID-19 crisis.

10.3 Postpandemic Use of the Digital Saathi Program and Its Benefits

Though many of the Digital Saathi groups were dismantled once schools reopened, many continued as local learning support centers, led by a local volunteer. This proved a boon for illiterate parents who were unable to provide the required academic support at home to their children.

Most student's families, and even us as an organization, cannot afford to secure individual access to smartphones for all students. Thus, the group use of one smartphone was a much more viable and cost-effective solution. It also allowed for peer learning among the group, which spanned multiple age groups.

Our Gyan Setu proved particularly effective for keeping girls in school. Girls often drop out during middle and high school for safety reasons if their village has no nearby school (Ministry of Health and Family Welfare 2021). A local learning center in the community enables girls to continue their schooling, eventually receiving a high school certificate from the open schools.

Another benefit of the program was to empower girls by improving their digital literacy. A large gender digital gap exists in India and other South Asian countries, which rank globally as having the biggest divide. A study by the Internet and Mobile Association of India (IAMAI) reveals that only 26% of Indian women have access to the internet, compared to 42% of men. About 25% of the total Indian female adult population owned a smartphone, compared to 41% of adult men (Isaac 2023). Patriarchal control over women's and girls' behavior and their exposure to outside influences is the main driver of this gap. Unmarried girls are denied access to mobile phones to keep them chaste, while for married women it would interfere with their household duties. Following the pandemic, several of our school-affiliated Digital Saathis were motivated to get mobile phones for themselves. Their parents too were supportive of their daughters having mobile phone access given the advantage for the entire family.

An important lesson from this innovative program and other creative solutions during the pandemic for governments to adopt and scale is that *distributed learning spaces* in local communities are a way to reach out to large numbers of students, especially those most vulnerable like girls. It also points out to the efficacy of a *distributed teaching model*. Instead of a one classroom–one teacher model, we should be thinking in terms of collaborative learning teams like in Khushboo's case where a local facilitator—educated, motivated, and empowered by digital technology—teamed up with more skilled teachers to ensure quality learning for students who would have otherwise been denied the opportunity. More local facilitators like Khushboo should be identified and recruited. This model also empowers local communities by giving them a sense of ownership and participating in their children's education. Research shows that parental involvement is conducive and improves learning in children (Winthrop et al. 2021). Giving women in remote rural areas access to the internet and online materials opens up a world for self-learning. Furthermore, technology allows us to multiply the human and material resources available to us and share them over large physical distances, thus going beyond the traditional school model where teaching is done exclusively by professionals and learning is confined to classrooms. It democratizes education by decentralizing control, involving more local partners, parents, older siblings, alumni,

and unemployed educated youths, especially women. Experts in various fields can also be recruited, as we did, to deliver important health-related information (including mental health) and to enable local facilitators to engage communities in discussions around locally relevant issues, such as gender-based violence, girls' right to education and autonomy, boys' and men's roles in achieving gender justice, and the detrimental effects of patriarchy. SHEF has continued to do this with a fair degree of success. With so many more stakeholders, this learning team model has great potential to increase learning and life outcomes for students.

The world was held ransom by technology during the pandemic, and the digital divide showed its ugly exclusionary face very starkly. However, the crisis also gave rise to many creative responses that taught us important lessons which might have eluded us. Though much of the technology existed before the pandemic, these creative and inclusionary solutions allowed education systems to leapfrog some endemic problems. Educators, governments, and policymakers need to shift away from a traditional one classroom–one teacher mindset toward a learning teams model. Professionals should team up with less skilled local community-based volunteers and/or workers and facilitators to expand the reach of their skills and contextualize their teaching locally. Priority focus should be to eliminated the digital divide and empower remote areas and vulnerable populations through digital access and connectivity. The advent of artificial intelligence opens another world of possibilities, but we must make sure it is in service of populations previously excluded from the benefits of technology, especially women in rural areas. In this digital age, this priority is even more urgent to ensure equity and inclusion.

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11

Learning Against the Tide: Making the Education System Flood-Resilient in Bangladesh

Kazi Iqbal and Siban Shahana

11.1 Introduction

The impact of the coronavirus disease (COVID-19) pandemic on education and its associated irreparable learning losses remind us that natural hazard events such as floods can inflict a heavy toll on the education system. This has been the case in flood-prone Bangladesh. Floods impair both the supply- and demand-side inputs of a typical education or learning production function. As more robust evidence emerges about learning loss due to the pandemic in many developing countries (e.g., Singh, Romero, and Muralidharan 2022), we see the need to get a comprehensive picture of how floods impact education outcomes in Bangladesh. Understanding this is critical as it may lead to innovative solutions to recover the learning losses and bring back dropout students to schools, similar to the novel approaches that emerged during and after the pandemic (ADB 2022).

The literature on the impact of floods on education outcomes is very thin. To the best of our knowledge, Hoque, Iqbal, and Roy (2024) is the first robust study to establish the causal relationship between the extent of floods and academic performance using school census and satellite image-based flood measures in Bangladesh at the union level (lowest administrative level) during 2011–2018. Their results show that passing rates and grade points averages drop significantly in secondary schools during the flood season, and the impact is more pronounced for girls, indicating that floods exacerbate gender parity in education in Bangladesh. Specifically, in the case of public examinations, the passing rates decreased by 4%–9% if the flooded

area of a union increased by 1%. but the passing rates of female students were about 2 percentage points lower than the male students in the Secondary School Certificate exams. Although many perceive the impact of natural hazards on education as indirect and long term, this study provides robust evidence on the direct and immediate impact of floods on education outcomes.

While robust evidence is short in supply, there is ample anecdotal and descriptive evidence suggesting the severe impact of floods on education institutions, dropouts, and learning deficiency of the students and the inconveniencies of both the students and teachers in attending schools. The World Economic Forum (2022) noted the increasing rate of climate-induced dropouts of children in Bangladesh. According to the Primary School Census of 2021, 10.24 million students were enrolled in 65,000 public primary schools. The dropout rate in 2021 was alarming: about 17% or more than 2 million children. It was observed that a large share of this dropout was due to climate change.

In the most recent flood of May 2022, about 5,000 schools were closed and more than 1,000 schools damaged, affecting over 1.5 million students. Flooding led students to lose up to 40% of their school year (Theirworld n.d.), impeding cognitive development and skills acquisition. The northwest region, particularly the Sylhet district, was worst-hit—more than 3,000 primary schools in this district were closed for weeks after the flood receded. Around 1.8 million children were directly affected in this district (Arab News 2022). Parvin et al. (2022) surveyed 30 primary schools in Satkhira districts of Bangladesh to study the impact of cyclone Aila on infrastructure (buildings, materials, furniture) and to assess the role of disaster knowledge as a coping mechanism. The study found that 90% of the schools were damaged. While disaster training and participation improved significantly, about half of the students were found to lack adequate understanding about disasters and disaster preparedness. Key factors influencing students' knowledge include family income, age, nongovernment organization (NGO) support, and student–teacher ratios. Several descriptive studies in other countries (Brouwer et al. 2007; Paul 2010) also documented adverse effects of floods on school attendance, dropout rates, and cognitive and emotional development, disproportionately affecting disadvantaged children.

In this short reflection note, we do not establish any causal relationships, nor provide a comprehensive stocktaking on this issue. Rather, we highlight key issues to help the government and NGOs design plans and programs for better resilience and mitigation of the adverse impacts of floods on our education system. First, the understanding of how floods impact educational outcomes is central to designing policies and interventions, as the relationship involves complex, multiple layers of interactions among teachers, students, parents, local communities,

school management committees, local NGOs and activists, and government. For example, villages that are more prepared to mitigate and adapt to floods are also those that are more likely to be able to keep learning going during floods. This community-level preparedness is vital in developing a flood-resilient education system. Second, as we found, the damage to school infrastructure, furniture, sanitation and water, and access roads is severe and repetitive in nature; this calls for a yearly allocation from the revenue budget. Currently, the government follows a uniform design for all public primary and secondary schools. Instead, the structural design and architecture of the schools should be more resistant to disaster in flood-prone areas, similar to schools that function as shelters in the coastal belt in southern Bangladesh. Third, it appears that the loss of learning in English and mathematics are more severe than in other subjects. The alternative modes during floods and extra hour coaching in post-flood periods should prioritize these two subjects. Fourth, about 1 in 25 students drop out every year due to floods, but only in flood-prone areas in Bangladesh. Bringing these students back to school is a daunting task, and the government should use separate programs to target them. Finally, while many effective initiatives have been taken by the government, NGOs, and the private sector, these activities remain sporadic, uncoordinated, and lack scalability. Hence, a comprehensive plan for a disaster-resilient education system is required involving all aspects of learning continuity and recovery, responsive education administration, parents and community engagement, coordination and collaboration among agencies, educational technology or edtech, and so forth. We have documented 10 such aspects of a resilient education system for educational institutions in flood-prone areas.

11.2 Descriptive Evidence of the Impact of Floods on Education

This section is based on educational institution-level data collected by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Bangladesh Bureau of Educational Information and Statistics (BANBEIS) in 2014 in 12 geographically distinct areas in Bangladesh which are vulnerable to disaster and climate change.[1] The

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[1]   Central coast (Char Fasson, Bhola), southeastern coast (Maheshkhali and Pekua, Cox's Bazar), river adjoining areas (Chauhali, Sirajgonj), river island areas (Char Rajibpur, Kurigram), areas close to rivers (Madarganj and Melandaha, Jamalpur), deep floodplain areas (Keshabpur, Jessore), southwestern coastal regions (Shyamnagar, Satkhira), Haor regions (Mithamain and Itna, Kishoregonj) and Barind tract (Nachole, Nawabgonj). The schools are randomly selected and are representative of these disaster-prone areas.

Table 11.1: Sample Educational Institutions and Their Size

Level of Institutions	Number of Institutions	Students per Institution	Boys per Institution	Girls per Institution	Teachers per Institution	Male Teachers per Institution	Female Teachers per Institution
Primary	843	266	131	136	5	2	3
Secondary	550	477	227	249	14	10	4
Madrasa	329	440	195	245	17	15	2
College	78	673	341	332	29	23	6
Total	**1,800**	**380**	**181**	**199**	**11**	**8**	**3**

Source: BANBEIS (2015).

survey covered all disasters that include as cyclones, floods, river erosion, flash floods, landslides, droughts, waterlogging, salinity intrusion, and earthquakes. In this analysis, we consider only floods, flash floods, and river erosion.[2]

To get a sense of the types and sizes of educational institutions included in this sample, Table 11.1 illustrates the average sizes of the institutions and the distribution of students and teachers disaggregated by gender by level of educational institution. Primary schools constitute about 47% of the sample, with an average of 266 students and 5 teachers per institution. The average size of secondary schools and madrasas is greater than primary schools, while colleges have the highest number of students. The number of female students and female teachers is higher in primary schools than in any other type of institution in this sample.

Next, we document the list of problems educational institutions faced due to floods and subsequent issues (Table 11.2). About 42%–50% of institutions of different categories experience severe floods every year. While half of primary schools are impacted by floods every year, madrasas are more vulnerable to damage. About 60% of the institutions reported that floods damaged the approach roads to schools and playgrounds.

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[2]   In the rest of this essay, the term "floods" refers to these three types of disasters, unless specified separately.

Table 11.2: Types of Vulnerability by Educational Institutions Located in Flood-Affected Areas

Vulnerability	Primary School	Junior/ Secondary School	Madrasa	College	Total
Severe flood impact every year	419 (50%)	232 (42%)	156 (47%)	31 (40%)	838 (47%)
Experiencing moderate level damage every year	488 (58%)	316 (57%)	217 (66%)	44 (56%)	1,065 (59%)
Dysfunctional water supply and sanitation facilities	438 (52%)	289 (53%)	169 (51%)	39 (50%)	935 (52%)
Prolonged flood conditions disrupt students coming to school	506 (60%)	332 (60%)	192 (58%)	45 (58%)	1,075 (60%)
Students cannot use playgrounds during floods	525 (62%)	318 (58%)	200 (61%)	43 (55%)	1,086 (60%)

Note: Figures in parentheses are the percentages of educational institutions that experienced various types of vulnerabilities.

Source: BANBEIS (2015).

11.2.1 Damage to Educational Institutions

We also document the severity of damage to schools by flood type (Table 11.3). The monetary damage due to river erosion was highest; the loss was as high as about Tk500,000.[3] Floods affected 1,199 institutions and caused damage of about Tk300,000. Flash floods caused the least disruption; only 52 schools were reported damaged and suffered a monetary loss of Tk80,000.

Table 11.3: Monetary Loss Due to Floods (Tk)

	Observations	Mean	Standard Deviation
Flood	1,199	279,231($3,602)	821,297
River erosion	193	473,476 ($6,108)	1,658,324
Flash flood	52	81,865 ($1,056)	136,316

Source: BANBEIS (2015).

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[3] $1 = Tk77.56 in 2014 during the survey. Tk500,000 is equivalent to $6,450.

Table 11.4 documents the disaggregated inputs that suffered irreparable damage in schools. More than half of the institutions reported that they could not recover from the damage to the building structure, furniture, and doors and windows. About 35% of the institutions reported irreparable damage to water supply and 40% to sanitation systems, underscoring health and hygiene concerns. Damage to connection roads was reported by 32% of institutions, implying issues with accessibility and thus absenteeism even when the institutions are open.

Table 11.4: Damage Due to Floods That Institutions Could Not Recover from Most Recent Flood

Type of Damage	Frequency Reported	%
Building structure	916	51
Furniture	987	55
Roof	244	14
Doors and window	944	52
Water supply systems	630	35
Disrupted sanitation	722	40
Connection roads	570	32

Source: BANBEIS (2015).

11.2.2 Impact of Floods on Educational Outcomes

The first and foremost channel through which floods impact education outcomes is school closures, which result in a drop in teacher–student interaction hours. Table 11.5 shows that floods caused an average closure of about 18 days, river erosion about 16 days, and flash floods about 12 days. About half of the institutions experience floods every year, and they lose about 18 days of schooling in a year.

Table 11.5: Number of Days of School Closures, 2014

Cause of School Closure	No. of Observations	Mean	Standard Deviation
Flood	1,147	18.48	64.69
River erosion	182	16.03	19.03
Flash flood	49	12	5.44

Data source: BANBEIS (2015).

Floods also affect households in several ways that ultimately disrupt schooling. The disruption of both household-level inputs (e.g., displacement, shocks to employment and income, damage to houses) and school-level inputs was such that school closures may lead to students dropping out. In this survey, about 22% of institutions (397 out of 1,800) experienced dropouts (Table 11.6). About 16 students dropped out in the institutions that reported dropouts, with an average of 8.43 for boys and 7.95 for girls.

Table 11.6: Dropout Due to Floods

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Boys	376	8.43	9.39	1	74
Girls	390	7.95	9.38	1	85
Total	**397**	**15.62**	**16.13**	**1**	**98**

Data source: BANBEIS (2015).

Table 11.7 highlights the subject-wise learning losses due to floods and other disasters, differentiated by institution type and the extent of the severity of the loss. English and mathematics are the subjects most affected by disruptions. These two subjects saw the least recovery using home-based learning, often below 5%. These losses were most notable across all institutions, with over 55% of students finding it hard to catch up if they miss school. In contrast, subjects like Bangla, religious studies, and others are less affected, possibly due to their lower level of rigor and their higher probability that home-based learning can recoup losses. There is no evidence that being affected by floods increases resilience and adaptation ability in following years.

Table 11.7: Subject-Wise Learning Loss Due to Floods (%)

	Primary			Secondary			Madrasa			College		
	Can make up at home	Difficult if absent in school	Permanent loss when fall behind	Can make up at home	Difficult if absent in school	Permanent loss when fall behind	Can make up at home	Difficult if absent in school	Permanent loss when fall behind	Can make up at home	Difficult if absent in school	Permanent loss when fall behind
Bangla	75.17	10.42	14.41	87.28	4.59	8.13	77.65	9.50	12.85	83.87	3.23	12.90
English	2.12	59.76	38.12	2.06	59.18	38.76	1.20	63.47	35.33	1.79	58.93	39.29
Mathematics	2.19	59.66	38.15	2.04	57.78	40.19	1.20	62.65	36.14	0.00	57.69	42.31
Social science	15.37	56.67	27.96	14.85	58.62	26.53	12.44	65.07	22.49	13.16	60.53	26.32
Science	77.34	13.54	9.11	76.86	13.73	9.41	71.14	20.13	8.72	77.27	18.18	4.55
Religious studies	88.92	5.26	5.82	90.80	4.00	5.20	86.36	8.44	5.19	96.15	0.00	3.85
Other	84.95	4.84	10.22	88.89	6.35	4.76	83.33	12.82	3.85	93.75	0.00	6.25

Data source: BANBEIS (2015).

11.3 Policies and Interventions

Addressing the challenges faced by the education sector due to repeated floods through effective policies, programs, and practices that enhance the resilience and adaptation of students, educators, and communities affected by flooding is essential to minimize its long-term effects. Interventions like floating schools, climate-smart curricula, school-based disaster risk reduction, and social protection schemes can help address these challenges. Innovative solutions like floating schools have been proven to be very effective, and now there are about 100 floating schools in Bangladesh serving nearly 4,000 students. Local initiatives are also noteworthy: Shidhulai Swanirvar Sangstha, a local charity, has built boat schools that navigate the Atrai River, providing a unique solution during monsoon seasons (Beaubien 2018).

Bangladesh has adopted many policies and practices to mitigate the educational impact of floods. The National Adaptation Plan proposes interventions for education to develop climate-resilient curricula and textbooks, enhance teacher training and student awareness of climate change, establish climate information centers in schools, and improve school infrastructure and facilities. This includes formulating a comprehensive disaster risk reduction strategy, integrating disaster risk reduction into the national curriculum, and establishing school safety committees.

While there are many initiatives, it appears that they are not a part of any comprehensive plan for making the education system resilient to floods. We propose key aspects of a resilient education system that the Government of Bangladesh can take a cue from to prepare a comprehensive plan that can withstand, adapt to, and recover from the impacts of floods, ensuring learning continues during and after such disasters.

Table 11.8: Key Aspects of a Resilient Education System

Aspect	Description
Learning continuity and recovery	Learning continues during disruptions and rapid recovery once the disruption is over.
Responsive school education system and service delivery	The schooling system is transformed to adapt to negative situations during disruptions. Alternative modes of education delivery, such as radio or television broadcasts, are available in areas with limited internet connectivity. School curricula and textbooks reflect adaptation during and after disruption. More support is available for vulnerable students.
Technology and educational technology	Digital infrastructure, tools, and edtech are available for maintaining learning continuity in the service delivery system. Teachers are equipped with technical tools to deal with disruption in learning continuity and provide education services. Children are equipped with independent learning technical devices or tools.
Children's safety and adaptation	Children are safe from the negative consequences of disasters, particularly flood-prone vulnerability. They are equipped with the adaptation process of learning continuity, including receiving mental health and social support. They are equipped to learn independently during disruptions.
Well-prepared educators	They receive training to acquire skills and knowledge of technology to deal with disruption in learning continuity and provide education services. Teachers and school principals are responsive during disruptions, learn from experience, and prioritize learning continuity and recovery. They also receive pedagogical, mental health, and social support.
Disaster preparedness	Disaster preparedness and risk reduction education are included in the curriculum to help students and communities better prepare for and respond to future disasters.
Parent and community engagement	Communities and parents are mobilized to receive support for maintaining the learning continuity of children.
Local education agencies	Local education agencies are responsive during disruptions, learn from experience, and prioritize learning continuity and recovery.
Monitoring and accountability	Monitoring and accountability of local education agencies, teachers, and school principals are in place so that they prioritize, respond, engage in learning continuity and recovery during and after disruptions, and provide feedback learning from experience.
Coordination and collaboration	Coordination and collaboration between stakeholders such as government agencies, nongovernment organizations, and local communities are important in building a resilient education system.

Source: Authors.

11.4 Concluding Remarks: Policy Suggestions

In the face of increasing flood-induced disruptions, Bangladesh's education system requires a comprehensive, multifaceted approach to ensure the continuity and resilience of learning. Based on several aspects of a resilient education system, we reiterate the following policy measures.

11.4.1 Enhancing the Resilience of the Education System in Flood-Affected Areas

Strategies to bolster Bangladesh's education system against flood impacts include conducting a comprehensive needs assessment, integrating interventions into strategic plans, researching alternative education methods, and collaborating with formal institutions. Enhancements involve integrating traditional coping mechanisms into formal disaster risk reduction strategies and adopting a child-centered approach to leverage community resources. Additionally, incorporating health and well-being aspects into the education system, alongside knowledge of empowerment and nonformal education, can provide essential support for disaster-impacted children.

11.4.2 The Imperative for Climate-Resilient Curriculum Changes

Initiatives should be taken for climate-resilient curriculum changes, integrating climate change education across subjects and grades. For example, MIT has developed a multidisciplinary curriculum on climate change for high school students (Zimmerman 2023). Bangladesh can customize such teaching materials for their own use. Moreover, students displaced by floods need adaptive, inclusive curricula, including accelerated programs and so-called learning recovery programs to counteract learning loss, with priority on science and mathematics.

11.4.3 Leveraging Edtech in Flood-Induced School Closures

Edtech is crucial during flood-induced school closures, providing alternative learning methods. However, challenges such as digital infrastructure and literacy, device ownership and internet access, and teacher training need to be carefully addressed. Many experiments on remote learning during the pandemic apply directly for flood-affected

areas. For example, the COVID-19 School Sector Response (CSSR) project supported 3.26 million children with distance learning programs using 5,000 digital contents for pre-primary to grade 10 in Bangladesh (DPE 2021). Although not part of the CSSR project, platforms like EduHub, developed through a collaboration between the Government of Bangladesh and key development partners, are examples of initiatives aimed at expanding digital learning opportunities. However, the reach of resources like EduHub is limited to children with internet access, primarily in urban regions. To address this, UNICEF Bangladesh identified mobile phones as an effective tool to support learners without internet access in remote areas.

11.4.4 Subsidizing and Incentivizing Innovations at the Local Level

Encouraging innovative initiatives at the local level is critical for developing alternate delivery modes for vulnerable students, particularly in remote areas. NGOs and the private sector can play key roles in this respect, and the government and other development partners should incentivize such initiatives. For example, the United States Agency for International Development awards grants to a Bangladeshi youth group that won third place for their project to improve climate literacy and create a climate-based school curriculum for young students (USAID 2023).

11.4.5 Enhancing Local Institutional Responsiveness to Flood Disruptions

Policies should enhance the preparedness of local education agencies for flood disruptions and promote inter-institutional collaboration and accountability. Apart from learning loss, the damage to infrastructure and access roads is also severe, which calls for routine monitoring and allocation of public funds. This can be achieved by empowering local government through policy guidelines and training, implementing monitoring mechanisms, and fostering cooperation between government agencies, NGOs, and communities. Cross-country evidence (Iqbal and Ahmed 2015) suggests that greater decentralization improves disaster management in developing and transitional economies.

11.4.6 Constructing a Dynamic Resilient System for Improved Learning Continuity and Recovery in Flood-Affected Areas

Policies should encourage a dynamic, resilient education system, encompassing an integrated education management system, feedback mechanisms, collaborative partnerships, data-driven decisions, adaptive learning, resilience programs, and regular policy updates. This system would facilitate continuous improvement, efficient management, and stakeholder engagement, ensuring learning continuity in flood-affected regions of Bangladesh. To ensure learning continuity during and after floods, the government launched initiatives like Education in Emergencies (EiE) and Back-to-School Campaigns. Bangladesh's Comprehensive Disaster Management Programme has significantly shifted from a reactive disaster response to a proactive comprehensive risk reduction approach. Akram, Chakma, and Mahbub (2012) conducted an evaluation of EiE project and found that the selection of alternative learning places was critical for the continuation of schooling in flood-prone areas. Schools that received the interventions were not closed for a single day. The project was also found to benefit non-project schools as they later adopted the project's strategy to cope with the disasters.

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PART III
Building Resilience

12

Ahead of the Game: Improving Education Systems Now to Prepare for Future Disruptions

Daniel Rodriguez-Segura and Caroline Whitcomb

12.1 The Progress Needed Toward Resilience

Education systems that cannot deliver strong learning outcomes during times of business-as-usual education and times of disruption compromise the future well-being of the children and countries that they serve. For instance, the recent coronavirus disease (COVID-19) pandemic, and the school closures associated with it, led to forgone human capital accumulation in the form of learning loss, school dropout (Patrinos, Vegas, and Carter-Rau 2022; Moscoviz and Evans 2022), and shocks to the well-being of the teacher workforce (Zamarro et al. 2022). School closures led to the loss of over half a year's worth of learning gains, on average, and could result in a loss of up to a year of educational achievement, adjusted for quality (Patrinos, Vegas, and Carter-Rau 2022). Children of lower socioeconomic status felt these challenges most profoundly, and close to 11 million children could drop out of school because their households experienced income shocks (Azevedo et al. 2021). Children from lower socioeconomic backgrounds struggle to recover from negative educational shocks relative to their more advantaged peers, potentially widening preexisting inequalities in educational outcomes even further (Andrabi, Daniels, and Das 2021). The educational disruptions the pandemic caused will affect not only the life outcomes of the current younger generations but also those of subsequent generations, as well as the overall economic development of many countries. Thus, this worldwide crisis exposed how unprepared most schools and bureaucracies in low- and

middle-income countries are to successfully keep their children safe and learning in times of crisis.

Serious disruptions to education that can threaten the present and future well-being of children happen often, although not always on a global scale. Disease-related school closures have affected Cambodia, the People's Republic of China, and Sierra Leone in recent years; pollution-related school closures have affected parts of Mexico; and natural hazard events such as floods and earthquakes have affected regions of India and Pakistan (Angrist et al. 2023). Experts predict that climate change–related natural hazard events will continue to increase in frequency and intensity (United States Geological Survey 2023), likely increasing the need to temporarily close schools around the world, which will further threaten consistent educational achievement—especially when school systems are not prepared to address these challenges (Kamenetz 2022).

Given the potential for more frequent and severe disruptions to education worldwide—and the detriment this poses to human development—policymakers are rightly concerned about strengthening their education systems in preparation for the next disruption. These concerns are particularly justified since the recent pandemic exposed the lack of preparation and adaptability of many educational institutions to swiftly respond to changing circumstances. However, as forward-looking policymakers aim to increase the resilience of their systems before the next shock, it is important to acknowledge that, although disruptions do occur frequently, the specific circumstances of each can vary widely. For example, while disruptions linked to highly contagious viruses like the one that causes COVID-19 might require social isolation and at-home learning, other types of disruptions, such as those caused by earthquakes or other natural hazards, theoretically do not prevent people from gathering and resuming in-person instruction at an appropriate time, even if infrastructure is severely damaged. The recent experience during the pandemic should serve as a warning to policymakers about the need to have resilient education systems, but it should not be seen as an opportunity to overcorrect and address only the flaws that the specific circumstances of this pandemic highlighted.

Given the role educational technology (edtech) played during pandemic-induced closures to keep children learning and engaged while isolating at home, policymakers might be inclined to prioritize certain edtech solutions that provide some sort of at-home instruction. However, even when children experience some kind of education disruption during their lifetime, most of their academic career will still be spent in business-as-usual education, at school. For instance, Azevedo et al. (2021) estimated that the pandemic may have led to "a loss of between 0.3 & 0.9 years of schooling adjusted for quality, bringing down the effective years of basic schooling that students achieve […]

from 7.9 years to between 7.0 & 7.6 years." Focusing policy efforts on the narrow future periods of disruption would also mean focusing on a smaller portion of future pupils' academic careers, especially relative to policies that aim to improve the status quo in education while they are in school. Therefore, addressing the poor quality of education that pupils receive during traditional education is a more effective approach to reach more pupils, at a deeper level and for longer, than focusing on at-home interventions ahead of future disruptions that may prevent them from attending school for a certain period.

The best way to foster a resilient education system is to maximize the value of classroom instruction to ensure that children are learning while they are in school. Efforts in this direction are likely to spur changes within educational systems that will then allow them to be more resilient in the face of unpredictable challenges. This is particularly true since most students in low- and middle-income countries cannot read with comprehension (World Bank et al. 2022), making it challenging to provide high-quality remote instruction—for instance, teaching children how to read without access to a blackboard or piece of paper to show the connection between each letter and their respective sounds. Hence, improving learning outcomes while pupils are in school is likely to enable education systems to react more effectively in the event of future school closures. Similarly, aligning an education system toward learning outcomes also means a level of sector coordination and reorganization in a way that puts student well-being at the core of the education system, instead of emphasizing other goals, such as complying with bureaucracy or extracting private benefits from the education system. An education system where all stakeholders are aligned and incentivized to drive higher learning outcomes is one that is likely to respond swiftly and effectively to the benefit of students, both in a business-as-usual context and when facing future challenges like school closures.[1] Importantly, multiple interventions have proven to effective at improving learning outcomes at school (e.g., Banerjee et al. 2023), providing policymakers a valuable set of policy options to enhance conventional classroom education.

The thoughtful utilization of specific edtech interventions that are supported by a strong evidence base and a clear theory of change for the context in which they are implemented can significantly enhance

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[1]   While aligning an education system with learning outcomes is likely to correlate with broader stakeholder alignment in the face of future disruptions, the question of achieving this feasibility within the political constraints of policymakers is vital. However, this question extends beyond the narrow scope of the current essay on improving learning outcomes through a programmatic perspective, especially using edtech, and remains highly dependent on the political environment of each region.

children's educational experience in school. Consequently, edtech-based solutions can contribute to the development of more resilient educational systems that are better equipped to withstand future disruptions. In the following sections, we present potential pathways through which edtech can assist policymakers in strengthening their educational systems by improving classroom instruction during traditional education. Additionally, we highlight key considerations that policymakers should bear in mind to maximize the educational returns on their investments.

12.2 Understanding Edtech's Limits for System Resilience

More at-home access to edtech is not the most effective way to increase the resilience of an education system. Most edtech tools require access to inputs such as computers, phones, electricity, or connection to the internet. Therefore, the local availability of these technologies can influence the implementation of effective edtech interventions, particularly for at-home use. The availability of these inputs remains low, especially among the poorest students. For example, 30% of the population in countries like Vanuatu or Myanmar does not have access to electricity, and almost 12 million people lack access to electricity in larger countries like Pakistan. Additionally, about 38% of people in East Asia, South Asia, and the Pacific do not have access to the internet, rendering around 175 million people unable to engage with edtech tools that require an internet connection. Moreover, inequalities within countries in terms of access to necessary inputs for effective edtech use could hinder at-home education during disruptions (Rieble et al. 2020).

During recent school closures, certain at-home, technology-based interventions were effective in specific contexts, however, at keeping students engaged and at facilitating learning to some extent. For instance, individualized phone-based tutoring showed positive results in Bangladesh (Hassan et al. 2021), Botswana (Angrist, Bergman, and Matscheng 2022), and India, Kenya, Nepal, the Philippines, and Uganda (Angrist et al. 2023). Despite being one of the most promising at-home educational interventions during this period, several factors limit this approach's viability for sustainably enhancing education systems' resilience at scale or effectively addressing learning crises during more conventional situations.

First, this intervention did not consistently produce positive outcomes, as seen by null results found in trials that took place in Kenya

and Sierra Leone (Schueler and Rodriguez-Segura 2022; Crawfurd et al. 2023) or effects that fully disappeared 1 year later (Hassan et al. 2023). Furthermore, despite relatively high cell phone penetration in low- and middle-income countries, there are still areas with limited mobile penetration. For example, in India and Pakistan, there are only four cell phone subscriptions for every five inhabitants, and programs that have focused on providing the necessary technological inputs to students at an individual level have been costly and mostly ineffective. Even assuming universal access to cell phones, these interventions require a data management system with an updated roster of pupils and their phone numbers, which is not available in many contexts. Moreover, such interventions may disproportionately reach more advantaged students due to differences in response rates and patterns of cell phone utilization (Rodriguez-Segura and Schueler 2022). Lastly, in terms of pedagogy and efficiency, at-home education interventions remain a secondary option compared to effective classroom instruction. The scope of content coverage may be limited during remote learning, and instruction is delivered to only one student at a time, reducing the amount of time each student receives with teachers. This intervention can be a valuable tool for policymakers in times of certain serious disruptions—especially if those do not affect electricity provision or cell phone reception—but it is likely not the best investment in times of business-as-usual education.

12.3 Strengthening Classroom Instruction: The Key to Education Resilience

Instead, the best way to make education systems resilient is by improving in-classroom instruction. Improving in-school education is likely the most effective way to strengthen education systems ahead of future disruptions for multiple reasons. First, although children may experience occasional educational disruptions throughout their lifetimes that mean that they must learn outside traditional classrooms during those periods, the majority of their academic career will be spent in traditional classroom settings during business-as-usual education. For instance, the average pupil in East Asia, South Asia, and the Pacific is expected to spend between 11.6 and 13.8 years in school (UNDP 2022), whereas even the longest full school closures in the region, as of March 2023, — lasted between 1 year and 2 months in Kuwait and Bangladesh and 1 year and 5 months in the Philippines (UNESCO 2023) — only a fraction of the average child's expected time in school.

Second, classroom instruction, when properly structured and delivered, has the potential to reach a large share, if not all, of the

students in a classroom. This allows for more efficient utilization of teachers' time as they can simultaneously reach many children at once, especially when compared to more individualized interventions where each student only receives instruction for a portion of the time during which teachers are on task. Moreover, classroom instruction is not dependent on each child's level of access to technology at home, thus contributing to more equitable educational outcomes. Similarly, improving in-school learning outcomes, particularly in foundational subjects during the early grades, can be a powerful approach to reaching the most disadvantaged children before many of them unfortunately leave school in later years. By focusing on strengthening the teaching of foundational skills in schools, education systems can close learning gaps and provide a solid educational foundation for all students regardless of their background or access to resources.

Improving the in-school learning experience requires education systems to become internally strengthened, which will then grant them the benefit of capitalizing on existing resources and developing evidence-based approaches to enhance learning outcomes. By focusing on helping teachers deliver better instruction, governments can utilize the time and skills of teachers who are already on their payrolls and target children who are already enrolled in schools. Therefore, this approach not only has the potential to raise learning outcomes but also optimizes existing investments in the education sector. Furthermore, policymakers can now draw upon substantial evidence about devising effective policies. Substantial evidence over the past decades exists on what works to improve learning outcomes with in-school instruction in low- and middle-income countries (Banerjee et al. 2023). While further research and adaptation to local contexts are still necessary in certain areas, policymakers now have an initial "menu" of potentially effective interventions and policy design frameworks at their disposal, which many of their predecessors did not have.

Therefore, rather than solely focusing on reactive measures to address future disruptions, policymakers should prioritize proactive investments in instruction and educational learning outcomes. These investments can build resilience in the face of such events and elevate educational performance even before disruptions occur. By improving pupils' learning outcomes, self-efficacy, and independence, they can be better equipped to navigate short-term episodes of educational disruption in the future. Strong reading skills, for instance, enable pupils to learn independently from books, engage with remote tutors, or complete exercises from practice materials on their own. Additionally, education systems that prioritize delivering strong learning outcomes require system-wide alignment, which is achieved through

progressive reforms, stakeholder collaboration, and higher-level policy objectives (Spivack 2020). Realigning education systems during periods of business-as-usual education is therefore likely to strengthen their internal functioning and objectives, enabling them to respond more effectively during times of severe shocks.

12.4 Leveraging Edtech to Enhance Classroom Learning

Edtech can be a tool to improve the in-school learning experience. Evidence for effective edtech interventions that enhance children's in-school experience and subsequently improve learning outcomes has expanded rapidly in recent years (Rodriguez-Segura 2022). This growth in evidence provides policymakers with a clearer understanding of which interventions may address the specific shortcomings in their context, surpassing the knowledge available to their predecessors. When combined with other effective, non-edtech interventions and policy reforms that align stakeholders toward stronger learning gains, the potential impact on improving in-school education becomes substantial. In all, the emerging patterns in this expanding evidence base suggest that edtech interventions can be effective in enhancing pupils' learning experience in at least four key areas.

12.4.1 Complementing Instruction with High-Quality Materials and Content, at Scale

Teachers are a vital component in education systems, as their pedagogical practices and content knowledge can deeply impact student achievement (Chetty, Friedman, and Rockoff 2014). However, students' learning processes can be hindered if teachers themselves have gaps in their understanding of the subject matter. In Madagascar, Mozambique, Niger, Nigeria, and Tanzania, less than 1% of teachers were able to achieve a score of 80% on primary-level assessments in mathematics and language (service delivery indicators). Similarly, in the Philippines, when grade 6 and 10 teachers participated in a content knowledge assessment by the World Bank, the average Filipino teacher was able to correctly answer less than half of the questions on most subjects and grade levels (World Bank 2016).

Edtech interventions that provide high-quality content and integrate it with teachers' instruction and the expected curriculum can serve as an effective approach to bridge the gap between teachers' content knowledge and students' learning objectives, especially as

they minimize the extent to which the quality of instruction children receive depends on the teacher that happened to be assigned to them. Numerous successful interventions have achieved significant learning gains through this approach. For instance, Johnston and Ksoll (2017) conducted a study in Ghana in which live instruction was broadcasted via satellite to rural primary school students, resulting in improved math outcomes and foundational literacy subskills. Beg et al. (2021) examined a program in Pakistan that delivered expert math and science content through short videos with multimedia presentations in middle schools, effectively combining the multimedia content with teacher instruction. The program demonstrated positive effects on math and science outcomes, as well as increased student and teacher attendance. Similarly, Näslund-Hadley, Parker, and Hernandez-Agramonte (2014) studied the impact of delivering content that complements classroom instruction through prerecorded materials in Paraguay. The content aligned with the national math curriculum for preschool and was taught bilingually in Spanish and Guaraní to mirror the teaching conditions in Paraguayan schools, resulting in learning gains in math. Lastly, Naik et al. (2020) investigated an intervention in which technology-assisted teaching replaced a third of in-school instructional time to cover a portion of the state curriculum, leading to gains in math, science, and English. Importantly, the potential for mass delivery of this content makes such interventions highly scalable, and able to reach many children within an education system regardless of the quality and skills of their teacher. These examples highlight the potential of edtech interventions that integrate high-quality content with teacher instruction to address the gap in teachers' content knowledge and enhance student learning outcomes across the board.

12.4.2 Facilitating the Implementation of Structured Pedagogy Interventions

Structured pedagogy has emerged in recent years as a highly promising policy option for improving learning outcomes in low- and middle-income countries (Banerjee et al. 2023; Chakera, Haffner, and Harrop 2020; Piper et al. 2018). This approach typically encompasses a comprehensive package of inputs, including lesson plans, learning materials, and ongoing teacher training (Banerjee et al. 2023), and its value lies in its ability to enhance the quality of instructional practices across the education system, address content gaps among teachers, and ensure a consistent level of education for all students, regardless of their background. Moreover, it relieves teachers from the burden of lesson and course planning, theoretically allowing them to allocate more time

to teaching, while also delivering lessons that are more consistent at the lesson and course level.

Although many successful structured pedagogy interventions have not incorporated edtech components, technological integration has leveraged key advantages unique to its inclusion, such as mass distribution of lesson plans, content modification and improvement, and the ability to track usage metrics for targeted coaching and follow-up. Gray-Lobe et al. (2022) found that an intervention featuring structured pedagogy significantly improved learning outcomes in private schools in Kenya, while similar positive results were observed in Rwanda when a comparable model was implemented in government schools (Rodriguez-Segura, Rugwizangoga, and Lu 2023). Blimpo et al. (2020) also investigated a school-wide treatment with a technology component linked to the delivery of structured lesson plans in the Gambia, which yielded learning gains, albeit somewhat lower than those observed in Gray-Lobe et al. (2022).

Implementing structured pedagogy interventions typically requires additional teacher training to ensure effective implementation of the lesson plans. While evidence on technology-based teacher training and its complementarity with structured pedagogy is relatively limited, Kotze, Fleisch, and Taylor (2019) conducted a study comparing virtual teacher training modules with on-site training and found similarly positive effects for both programs. Yet, the virtual training was slightly more cost-effective and presented fewer logistical challenges for scalability, although the study's 3-year follow-up by Cilliers et al. (2020) revealed diminishing returns to virtual coaching in the long term.

While structured pedagogy is an evidence-based intervention on its own, proven to enhance learning outcomes in low- and middle-income countries, the potential benefits of integrating technology into these interventions could amplify their reach and effectiveness.

12.4.3 Providing Customized Feedback and Practice, Especially in Large Classes with Heterogeneous Levels of Performance

Many low- and middle-income countries face three simultaneous challenges within classroom instruction: large pupil–teacher ratios, relatively short effective instructional time, and large degrees of variation in students' learning outcomes. The combination of these factors makes it so that teachers might not have the time, resources, or ability to cater to every student's pedagogical needs. Certain edtech-based tools could potentially help customize practice and feedback for students. In theory, software has the capacity to hold a vast number of questions, with a

wide range of difficulty and minimal support required for children once they start using it.

Indeed, Muralidharan, Singh, and Ganimian (2019) tested an adaptive math software in Delhi which leveled its exercises based on students' performance, displaying significant learning gains. Similarly, Böhmer, Burns, and Crowley (2014) studied an after-school computer-assisted program in South Africa focusing on each student's particular weaknesses in math, giving students agency to pick whichever topics they wanted to work on. This program proved effective at improving math knowledge and, interestingly, raised foundational math knowledge more than it improved the grade-specific knowledge among students. In other words, by fully customizing the study program to each student's particular weaknesses, this program filled in content gaps that regular instruction might not have remedied, as mastery of foundational math skills was already assumed in the grade students were in.

Yet, for some of these interventions, it is unclear whether what drove the impact was indeed the customization of the content to their level or the additional practice time. For instance, Ma et al. (2020) evaluated an edtech intervention in relation to a comparable "pencil and paper" treatment and found that the edtech treatment arm was no more effective than the non-edtech arm, suggesting that part of the success of interventions that customize content or provide additional practice time may be because of the increased time engaged learning with appropriately leveled materials. Similarly, when the same intervention studied by Muralidharan et al. (2019) was built into the regular school day, the results were, for the most part, null (De Barros and Ganimian 2021). In all, while additional practice and customization of feedback and content are important to help students learn, there may also be benefits to non-edtech interventions that address these issues, particularly if they do not replace in-school instructional time and instead add to the existing school day.

12.4.4 Increasing Accountability and Desirable Behaviors Through More Data-Driven Transparency

Teacher behaviors that detract from the total amount of instructional time that children receive may be deeply detrimental to student learning outcomes and, ultimately, to the overall efficiency of education systems. Unfortunately, teacher absenteeism and time off-task are rampant in many countries. For example, researchers found that 24% of teachers in India were not in school when they were expected to be (Muralidharan et al. 2010). Even when teachers are present at school, they are not always actively teaching. These behaviors incur serious fiscal costs through

teacher salaries. For example, Muralidharan et al. (2010) estimate that teacher absenteeism alone is responsible for the loss of about $1.5 billion per year in India, and Schipper and Rodriguez-Segura (2022) estimate that this cost in Tanzania is between $120 million and $411 million.

Interventions, including those leveraging edtech—which help stakeholders have greater visibility into teacher behaviors on a large scale—can incentivize higher attendance and on-task behaviors. For example, Aker and Ksoll (2019) studied a mobile phone monitoring program, where students, teachers, and village chiefs were called on a weekly basis over a 6-week period to ensure adherence to a supplemental education program. Even though the phone calls provided no additional incentives beyond the monitoring, the calls proved effective at keeping stakeholders engaged and increased learning outcomes. Similarly, Gaduh et al. (2020) tackled the issue of teacher absenteeism in Indonesia and Duflo, Hanna, and Ryan (2012) in India by providing schools with cameras with timestamps, requiring teachers to take regular pictures with their students to prove that they were in school. Furthermore, both interventions conditioned at least a portion of the teacher's pay on their presence in school, as verified by the cameras. Both interventions proved effective at raising students' test scores.

Despite these successes, implementation and take-up play a major role in the effectiveness of this kind of intervention. For instance, Adelman et al. (2015) implemented an intervention which had, as one of its components, a platform where teachers could send daily photographs to verify teacher presence in Haiti, similar to the interventions in India and Indonesia. The program experienced very low take-up and serious logistical challenges at the time of implementation, hampering the effectiveness of the intervention. The authors mention that "the program faced challenges from the start, including delays and technical problems that made it hard to implement it as planned" and "there were so many problems getting schools ready for the pilot that the program ended up starting months late... This short implementation period reduced the chance of seeing any change in teacher behavior or student learning." Therefore, even if the intervention is grounded in context-specific constraints (i.e., teacher absenteeism) and properly rooted in a clear theory of change, the support of partners on the ground to ensure compliance is also key.

Finally, many education systems in low- and middle-income countries lack a strong information management system that allows policymakers to track students, teachers, and head teachers longitudinally across a wide range of measures, including learning outcomes. While a comprehensive database that contains students' updated contacts and demographic information in itself might not raise

learning outcomes, it is a prerequisite to develop further evidence-based interventions during times of traditional classroom instruction, to monitor the different educational investments of the government, and to swiftly respond to disruptions when the time arises.

12.5 Ensuring Sound Policy Design for Education Interventions

Edtech or not: careful policy design is needed before implementing any education intervention. Edtech can be valuable in improving educational outcomes under certain circumstances, but it should not be seen as a standalone solution to enhance an education system's resilience, nor as a universally effective policy choice. Instead, decisions about incorporating technology to improve in-school learning outcomes require careful consideration of contextual factors and targeted areas that require improvement. In other words, policymakers should prioritize edtech interventions if the specific "comparative advantages" of technology—such as the ability to customize or standardize content, or the capacity to reach many stakeholders at scale—offer more effective solutions to address the particular constraints that are hindering pupils from achieving higher learning outcomes compared to non-technologically based interventions.

Paying careful attention to the specific design features of interventions, and how they interact with teachers' daily experiences and use of time, plays a crucial role in determining the effectiveness of both edtech and non-edtech tools in improving classroom instruction. For instance, Berlinski and Busso (2017) study the provision of smartboards to grade 7 classrooms to enhance students' visualization of geometry lessons. While the intervention showed high take-up by teachers, it also resulted in negative effects in learning outcomes, likely due to the sudden inclusion of technology in lessons that teachers were already accustomed to teaching without technological aid. Similarly, interventions that aim to fully replace teacher instruction, rather than complement it, have not been successful in certain cases. Linden (2008) compared a computer-led intervention implemented as an in-school program (a substitute for in-class instruction) versus as an out-of-school addition (a complement to in-class instruction) among grade 2 and 3 students. The study found that while the intervention had negative effects as a supplement to instruction, it had positive effects when used as a complement to reinforce instruction. In a similar vein, Beg et al. (2021) examined an edtech intervention in middle schools in Pakistan and discovered that the most successful implementation occurred when

technology was used to complement classroom instruction, rather than attempting to bypass it. These studies highlight the importance of understanding the interaction between technology and the instructional context, and how this can greatly contribute to the effectiveness of interventions in improving classroom instruction.

Similarly, policy decisions about using edtech tools to enhance classroom instruction should also consider the current technological landscape and associated implementation costs at the local level. For instance, while the Republic of Korea boasts universal access to electricity and telephone facilities in all primary schools, only 45% of primary schools in India have electricity. In countries like Cambodia, Myanmar, and Nepal, access to electricity is available in less than 10% of primary schools (UNESCO 2012a). Similarly, internet access in schools is limited in certain countries, with less than 10% of schools in Bangladesh, the Kyrgyz Republic, the Philippines, and Sri Lanka having internet connectivity (UNESCO 2012b). Moreover, computer hardware remains scarce at the school level, with fewer than 20% of schools in India having hardware for individual-use products (Sampson et al. 2019).

In this sense, policymakers must weigh the marginal costs (costs that increase with the number of users) and fixed costs (one-time payments required for implementation). For instance, an intervention aiming to improve teacher attendance monitoring through smartphones may involve fixed costs associated with developing the tracking platform. Additionally, the marginal costs of such an intervention, such as providing smartphones at the system level, can vary significantly depending on the existing penetration of smartphones in that context. Especially when penetration rates of the necessary technology are low, governments may need to provide the hardware and infrastructure to implement such interventions, and as such, the expected gains for the education system must be very substantial to justify the large associated costs.

12.6 Conclusion

Improving classroom instruction is the most effective way to enhance the resilience of education systems against inevitable future disruptions. By focusing on more effective classroom instruction, policymakers can reach a larger number of students for a significant portion of their academic careers. Moreover, by elevating current learning outcomes, systems can better address future disruptions, regardless of their specific nature, as students with stronger foundational learning skills and socioemotional outcomes—two critical results of effective classroom

instruction—are better equipped to engage with independent work or remote instruction.

Thoughtful integration of edtech interventions that align with the local technological climate and that address specific limitations of the education system can be a valuable tool to raise learning outcomes during conventional classroom instruction. Technology can be particularly effective in providing customized and standardized content at scale, supporting teachers with structured pedagogy interventions, improving stakeholder accountability across the system, and collecting essential data to promptly respond to the needs of students during both status quo instructional time and periods of disruption. A comprehensive vision aligning systems toward learning outcomes remains essential to enhance the resilience of educational systems during future disruptions, and that edtech is just one component in the broader landscape of policy responses. By adopting a holistic approach, policymakers can create an environment where technology, along with other strategies, works in tandem to promote effective classroom instruction and builds greater resilience within education systems.

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13

Transforming Education Systems for a Climate-Resilient and Sustainable Future

Anna-Maria Tammi and Raphaëlle Martínez

13.1 Introduction

Global temperatures have risen 1.1°C above preindustrial levels, exacerbating the frequency, severity, and duration of weather and climate extremes (IPCC 2023). Over the past 60 years, temperatures in Asia and the Pacific have risen faster than the global average. Six of the top 10 disaster-affected countries are within the region. If nothing is changed, the region will remain the most affected by heavy rainfall, drought, heat waves, and intensifying tropical cyclones (ESCAP 2023). The implications of these climate changes have been far-reaching, not least of which is their impact on education: more school destruction, higher student absenteeism and dropouts, and reduced learning outcomes. Slow-onset phenomena, such as rising temperatures and changing rainfall patterns, lead to increased school absenteeism and impair cognitive development and academic performance—with declines of up to 15% over the long term (Randell and Gray 2019; Deuchert and Felfe 2013; UNICEF 2019). Overall, this further undermines economic growth prospects, which are already strained by global economic challenges.

Concurrently, Asia and the Pacific was grappling with a profound education crisis. In 2019, 27 million children and adolescents in the region were functionally illiterate, and 50% of children in half the region's countries could not read a basic sentence by age 10 (UNESCO, UNICEF, and Cambridge Education 2021). The challenges magnified with the onset of the coronavirus disease (COVID-19) pandemic: over 800 million children in the region experienced disruptions in their education due to pandemic-induced school closures, resulting

in an estimated 1.1 trillion hours of lost in-person learning (UNESCO, UNICEF, and Cambridge Education 2021).

The convergence of the education and climate crises has deepened inequalities within the region. Climate and environmental change disproportionately affects marginalized groups, including the poorest. In the aftermath of disasters, girls—already less likely to survive and more likely to be injured due to long-standing gender inequalities—are more likely than boys to be pulled out of school to help with care and domestic work in (UN Women Fiji 2014), further hindering their education and, in turn, their resilience against climate disasters.

Although key international agreements, including the United Nations Framework Convention on Climate Change (UNFCCC), the Paris Agreement, and the Sustainable Development Goals (SDGs), recognize education as a critical enabler for climate action, education systems in the region are ill-prepared. Specifically, education systems are grappling with challenges ranging from insufficient funding to shortages of trained teacher and inadequate infrastructure, all while attempting to address the multifaceted challenges of poor learning, ecosystem degradation, and climate change (Kwauk 2020).

Addressing the learning crisis amplified by climate change requires immediate transformative action, aiming to not only recover but also build more equitable education systems that would better prepare children for the present and the future of the climate and environmental crisis. As the world calls for transformative action on education (United Nations 2023), it is imperative to invest in climate-smart education systems that support greater resilience to both sudden and slow-onset climate threats and that make education more equitable and effective for climate action and environmental sustainability.

13.2 Advocating for Climate-Smart Education Systems: An Evidence-Based Case for Policymakers

Amid economic downturn and scarce domestic financial resources, it might appear daunting for policymakers to prioritize investments in climate-smart education systems. While the immediate focus is on economic recovery, job creation, and growth, our environmental situation demands urgent climate action (ESCAP 2023). Education stands as a multipronged solution, not only fostering a climate-resilient future but also acting as a catalyst for greener economic recovery and growth. Though requiring upfront investments, the economic and

environmental dividends will ultimately offset the costs of climate-induced impacts on education, including learning losses.

Climate change affects education both directly—hindering children's learning and decreasing academic performance through infrastructure damage, injuries, and loss of life—and indirectly by endangering livelihoods, food, health, and water security (UNICEF 2019; IDMC 2021; UNESCO 2020). In 2017, monsoons and floods closed and damaged over 10,000 schools in Bangladesh, India, Malaysia, and Nepal. Similarly, the recent Pakistan floods disrupted 34,000 schools (World Bank 2023). While specific figures for damage to educational infrastructure due to climate disasters remain insufficiently collected, broad estimates suggest that natural hazards led to $600 billion in damages annually to public infrastructure in low- and middle-income countries. This has direct implications for the education sector. For example, the Punjab Education Department in Pakistan costed the need of $954 million to reconstruct 18,000 devastated schools (Educations. pk, 2022). By 2030, transitioning to climate-resilient infrastructure will require up to $300 billion annually.

As the threats of climate change grow, disruptions are likely to intensify, jeopardizing students' education. Navigating the consequences of a shifting climate and education crisis requires recognizing the long-term costs of inaction. Neglecting or failing to protect and prioritize education would be short-sighted, given the vital role education has in combating climate change and promoting climate action. Both the UNFCCC and the Paris Agreement identify education as a "high-impact investment" that equips people with the understanding, knowledge, skills, values, and attitudes needed to address the climate crisis and become agents of change. Case studies from countries such as the People's Republic of China and the Philippines underscore the benefits of climate education in fostering eco-friendly behaviors and empowering students to drive change (Hoffman and Muttarak 2020; Wang et al. 2022).

Despite the clear evidence of climate change's toll on education and the recognized value of education in climate adaptation and economic recovery, education importance remains largely sidelined in many national climate strategies. A review of the nationally determined contributions (NDCs) and national adaptation plans shows that only 30% of the signatories to the Paris Agreement have embedded education within their NDCs. Most of these inclusions are cursory, limited to public awareness and curriculum, failing to address the comprehensive challenges climate change poses to education systems (UNICEF 2019; Anderson 2019; Kwauk 2021). When they do embed education in their NDC, like in Cambodia, the levels of finance requested for education

represent only 1 % of the total $2 billion required for adaptation actions for sectors such as infrastructure, agriculture, and water. Alarmingly, a mere eight out of 160 NDCs recognized the necessity for greener and climate-resilient educational infrastructure (Kwauk 2021). An even narrower lens reveals a worrying trend: girls' education—a vital element in driving long-term change for a climate-resilient future—is egregiously underrepresented with a mere three countries addressing its significance in their climate strategies (Anderson 2019).

Similarly, national education sector strategies reflect this trend. Although 92% of the educational plans from 100 countries and areas reviewed by UNESCO incorporated environmental terms, their inclusion was, at best, surface level (UNESCO 2021b). A subsequent UNESCO report highlighted that only 53% of the national education curricula from these countries reference climate change. Only documents from East Asia and Southeast Asia and Latin America and the Caribbean exhibited a substantial focus on the topic. Moreover, a mere 27% of 50 surveyed countries and areas designated budgets explicitly for climate education (UNESCO 2021a).

The pressing interconnected crisis of education and climate calls for a strategic reassessment of policy imperatives. Policymakers are presented with a pivotal decision: Either perpetuate inaction with consequent escalating costs or advocate for the integration of climate-smart education as a cornerstone for a resilient and sustainable future. By recognizing and harnessing the transformative potential of education, direct and indirect impacts of climate change can be mitigated and learning can improve, thereby facilitating a greener, more inclusive socioeconomic development.

13.3 Envisioning the Blueprint: Seven Dimensions of a Climate-Smart Education System
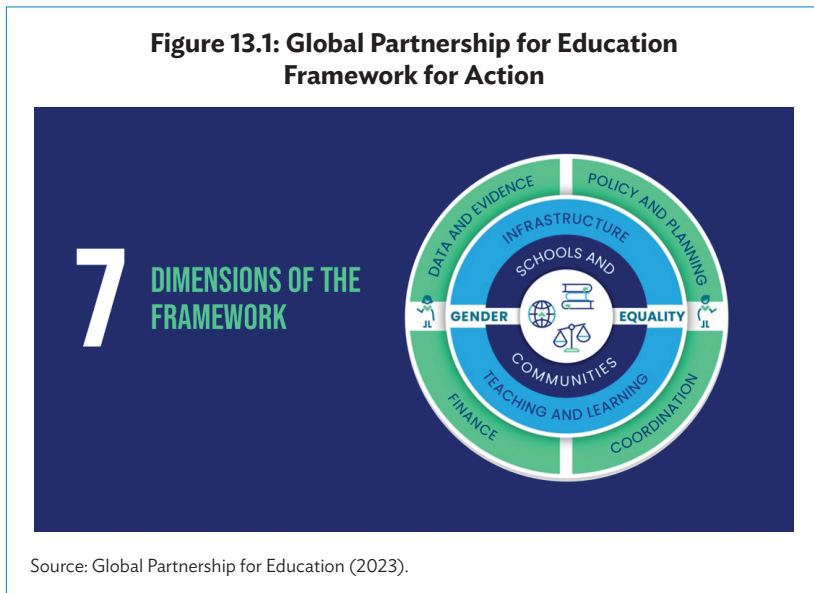
In the Global Partnership for Education (GPE) countries, policymakers are acutely aware of the pressing need to urgently address both education and climate issues. Partner countries requested the support of GPE in developing climate-smart education systems. In response, the GPE Secretariat developed "Toward Climate-Smart Education Systems: A 7-Dimension Framework for Action,"[1] a framework for action, which bridges the gap between current, disjointed approaches to climate

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[1]   Our essay is based on a rich background paper by Kagawa and Selby (2022).

resilience and climate action within the education sector (GPE 2022, 2023). Our framework is meant to be a practical tool for policymakers and practitioners in (i) supporting greater resilience of the education system to sudden and slow-onset climate threats and (ii) making education more relevant and effective for climate action.

The framework outlines seven dimensions of the education system that should be seen as interrelated, as achievements under one dimension are not sustainable in isolation. Each dimension highlights potential entry points within education systems to strengthen the resilience and relevance of education to climate change and environmental degradation, and vice versa, opportunities for leveraging the role of education in wider climate change, disaster risk, and environmental efforts.

Figure 13.1: Global Partnership for Education Framework for Action

Source: Global Partnership for Education (2023).

Gender plays a crosscutting role within the GPE climate-smart education framework, given the disproportionate impacts of climate change on girls and women and the potential of gender equality to enhance climate resilience and protect ecosystems. Research consistently highlights the significance of gender equality in education for addressing climate change challenges (INEE 2022; Malala Fund

2021; Sims 2021). In alignment with these findings, the GPE framework methodically embeds gender equity throughout its seven dimensions and in its support to partner countries.

13.3.1 Supporting an Enabling Environment

Data and evidence. It is paramount to systematically collect and analyze data related to climate risks, environmental degradation, and their implications for the education system. This foundational work not only enables evidence-based decision-making but also promotes peer learning and cooperation. Such an approach fosters innovative solutions and catalyzes stakeholder engagement.

Policy and planning. National policies and plans pertaining to education, climate, and environment lay the groundwork for comprehensively addressing the nexus between education and climate change. To encompass both the ramifications climate change has on education and the instrumental role of education in climate adaptation and mitigation, it is critical that the education policy frameworks and strategies factor in disaster risks, environmental conservation, and climate change objectives. Concurrently, national climate strategies and road maps, such as NDCs, disaster risk reduction plans, adaptation plans, biodiversity strategies, and action plans, should examine the pivotal contribution of the education sector. Regular monitoring and evaluation of these strategies enhances the understanding and fine-tuning of a climate-smart education framework.

Although the details are limited, nearly 60% of 68 high disaster risk countries have disaster risk management components in their education sector plan (Paci-Green et al. 2020). In particular, slow-onset hazards and environmental degradation are not sufficiently integrated (Kagawa 2022). Importantly, prevention should feature more prominently in educational planning at different levels in addition to preparedness—by considering the interlinkages between how environmental resources are managed and whether that increases or decreases the vulnerability of communities to the effects of climate-induced disasters.

Sector coordination. The efficacy of these policies is contingent on efficient coordination. This entails proactive engagement of education ministries in climate platform dialogue, bolstering of cross-sectoral collaboration, and optimization of current education coordination systems to address the needs of those significantly affected by environmental crises. At the heart of this coordination lies a robust accountability mechanism, crucial to protect the rights to education and welfare of the most vulnerable groups against the adversities of climate change.

Finance. The success of the aforementioned components hinges on adequate finance. Blending international funding dedicated to climate and education with domestic allocations can bring about outcomes for both education and the environment. Given disproportionate impacts of climate change on the most vulnerable populations, equitable financing mechanisms are necessary, targeting the children, schools, and regions most affected by climate change and environmental degradation.

GPE invests in better data and gender-sensitive education plans overall and promotes increased domestic financing for education as well as strengthened coordination among stakeholders. The support that we provide to education sector analyses and planning takes into consideration risks and vulnerabilities in the education system. GPE is currently providing funding toward education sector analysis, planning, monitoring, and addressing system capacity gaps in 14 countries in Asia and the Pacific.[2]

To address some of the above gaps, GPE is rolling out technical assistance to education ministries in the form of an initiative on climate-smart education systems implemented by Save the Children and UNESCO. The GPE initiative seeks to bolster the capacities of education ministries in several key areas: developing evidence-based policies for climate change adaptation; enhancing school resilience to climate threats; facilitating access to and integration of climate data in monitoring; ensuring effective inter-sectoral coordination around climate change; and embedding climate change themes in curricula and teacher training. While initially piloted in Malawi and Zimbabwe, the program will expand to 18-20 additional countries between 2023-2025, encompassing select countries in Asia and the Pacific.

13.3.2 Investing in Climate-Smart Education Inputs

The foundation of a quality climate-smart education system lies in its core inputs: resilient and climate-proofed infrastructure, qualified teachers, and relevant didactic materials paired with pedagogical technologies to ensure that learning remains an inclusive, continuous process, relevant to 21st century challenges and designed to shape students into agents of change. A blend of traditional methods and innovative education technologies is essential for learning continuity.

Infrastructure. New and existing schools should integrate climate adaptation and sustainability into their planning, design, construction,

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[2]   As of September 2023, these were Afghanistan, Cambodia, Indonesia, Kiribati, Kyrgyz Republic, Marshall Islands, Mongolia, Nepal, Papua New Guinea, Tajikistan, Tonga, Tuvalu, Uzbekistan, and Vanuatu.

and maintenance to ensure safe, healthy learning environments while minimizing their environmental footprint. School and community stakeholders should play an active role in making decisions about and maintaining the school infrastructure to ensure it becomes safer and greener.

In the Lao People's Democratic Republic, for example, GPE-supported projects emphasize climate-resilient design features in early learning facilities. These measures range from drainage improvements for flood control to tree planting initiatives aimed at protecting against erosion and landslides. In addition, the initiatives provide training for caregivers and teachers, enhancing their knowledge on emergency responses and environmental conservation principles. Similarly, in Maldives, GPE supports community disaster management plans, which include the creation of safe shelters. Efforts in Bangladesh have spurred community engagement in environmental protection, exemplified by tree planting initiatives. In Afghanistan, a move toward climate change mitigation has seen the adoption of compact fluorescent lamps in schools.

Curriculum. The curriculum's design, when combined with the right teaching materials and technology tools, is central to the larger goal of growing students into climate-aware change agents. Empirical data have shown that populations with foundational education skills can better comprehend risk-related information and recover more effectively from climate shocks (Peek et al. 2018; Muttarak and Lutz 2014). The integration of indigenous knowledge in the formal curriculum can also support the development of unique knowledge and skills for adapting to a changing climate. The close relationship of indigenous groups to their environments has been helpful during natural disasters (UNESCO 2021c). For example, following their deep-rooted connection with the environment, specifically by observing and understanding the changing sea levels after an earthquake, the Indigenous Peoples of Solomon Islands were able to survive a tsunami in 2007 by seeking higher ground (Magni 2016).

Educational technology. Adaptative pedagogies and technologies can support continuity of learning in the face of disasters. In Vanuatu, in 2020, coinciding with the onset of the COVID-19 pandemic, tropical cyclone Harold hit the country, destroying 885 schools partly or entirely and disrupting learning for thousands of students and teachers. In response, GPE allocated two grants to Vanuatu to support the education system's recovery from the cyclone, to address the challenges of the COVID-19 pandemic, as well as support preparedness for future crises that might necessitate school closures. The program supported the production of radio and SMS lessons to accompany home-schooling

packages, promoting inclusive and effective home learning practices. The broadcast lessons emphasized inclusion, psychosocial support, and child protection and allowed for quickly adapting to changing messages given the evolving and overlapping crises. The lessons were uploaded to the ministry's website for rapid use in future emergencies. The program also supported the production of home-schooling guidelines for caregivers, designed to be easily understood by caregivers with low literacy levels.

In Bangladesh, GPE supported the government to take a nationwide, structured approach to developing a distance learning system in response to COVID-19—this system can also be used in the event of climate-related disruptions. To reach the most marginalized children, the system was designed with both technology-based and print learning materials. The program supported the development of television, radio, and online lessons along with hard-copy learning packages. These materials covered the entire national curriculum for 35 core subjects from pre-primary to grade 10, supporting more than 1.5 million children. Schools can now cover a full academic year in remote learning mode.

Teachers. Teachers require support to implement quality pedagogy and standards that foster continuous learning and develop climate-sensitive student behaviors and practices. Climate change also affects teachers' ability to deliver quality learning. Teachers and their families are also victims of disasters. Additional pressure is placed on them as non-teaching work is often required in the aftermath of natural hazard events. Some teachers and education sector staff are displaced and forced to migrate. Education systems need to put in place capacity building opportunities for pre- and in-service teachers which focus on environmental and climate change–related curriculum content, as well as on practical knowledge and skills. Enhancing student health and well-being in situations of a changing climate and environmental degradation is another area in which teachers need capacity development support (Education International 2021). In Bangladesh again, the same GPE grant, almost 3,000 teachers received training on remedial education, formative and summative assessments, distance learning, and mental health interventions. This is the first time in Bangladesh that a mental health training of this scale was conducted.

13.3.3 Grounding Climate-Smart Education Systems in Schools and Communities

Schools should serve as community hubs enhancing local safety and resilience, by promoting environmentally sustainable practices in communities and including community members in the school initiatives

relating to climate change, disaster risk management, and environmental conservation, thereby tapping into their wealth of knowledge. Having school- and community-based engagement platforms for children and young people would enable them to exercise and hone their change agency, advocacy, and climate leadership capacities as they help take climate and environmental action forward.

Myanmar illustrates a case of support for climate-smart education systems where it is not feasible to work with governments. While GPE cannot support national planning toward preparedness, response, and climate action in such contexts, we are able to support the inclusion of some of these elements in the work that is done through partners in support of children, teachers, parents, and communities. Where partnership with the government is not fully possible, support can address the multiple sources of risk to children, thereby indirectly helping education to continue in cases of future climate-related disasters. A priority program of the partner-led Joint Response Framework is around contingency and preparedness planning for continuity of education. It calls for increased capacity of communities and community-based organizations (especially parent–teacher associations) for disaster risk reduction, climate change, and preparedness planning and early warning. In line with this, the GPE-funded grant supports improved community engagement and management of education, including strengthening communities' capacity to monitor and contribute to safe learning environments through planning for disaster risk reduction. The program also integrates disaster risk reduction into educator training and youth skills development.

13.4 Conclusion

The converging challenges of climate change and the persistent education crisis demand immediate, evidence-informed intervention. Empowering children and young people with quality and equitable education is crucial for unveiling sustainable solutions to climate change and ensuring environmental protection for all. Yet, education paradoxically stands as both an extremely vulnerable sector and a critical tool for mitigation and adaptation.

Responding to its partner countries' needs, GPE has developed a seven-dimensional framework for climate-smart education. This framework seeks to integrate education systems resilient against climate change and amplify education's relevance to climate action. It emphasizes that data-driven, coordinated, and inclusive approaches, which are intertwined with gender equity and adequately funded, are not just mere aspirations but imperatives. The multidimensional and

interdependent framework, which stems from various studies and global collaboration, emphasizes the importance of cohesive action and system-wide strategies. It works as a compass for policymakers and education stakeholders to design and finance education systems that are aware of and responsive to climate issues. The relevance of this framework is predicated upon its adaptability. While it provides a holistic overview of the different climate-smart elements of an education system, its practical implementation is contingent upon the specific socioeconomic, educational, and environmental contexts of individual countries.

Building climate-smart education systems can only happen if stakeholders are working in partnership across sectors and direct interests. Our goal is to create a coalition of actors that emphasizes the role of education in both climate resilience and climate action to encourage countries to commit to realizing climate-smart education systems through targeted policy actions and additional financing. Success in this venture will only be achievable through a concerted effort, where education practitioners, climate experts, policymakers, communities, and financiers come together.

As the climate changes and grows more unstable, there is no time to lose to ensure that all education systems are climate smart—ready to support resilience and build a sustainable future for generations to come.

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Building Resilience in Education Systems

In 2022, a flood in Bangladesh shut down 5,000 schools, disrupting the education of 1.5 million students. The COVID-19 pandemic forced school closures across Asia for more than a year, causing significant learning losses and reducing students' future earning potential. As disasters, conflicts, and other crises become more frequent and severe, education systems must develop strategies to minimize their impact.

Building Resilience in Education Systems presents 13 chapters on strengthening education system resilience, written specifically for policy makers and practitioners. The book examines diverse contexts, the sources of school disruptions, and key lessons learned. Featuring insights from Asia, Africa, and Latin America, it underscores that while solutions will vary by country, every nation can leverage its resources to build a more resilient education system.

"In a world where greater unpredictability is what is most predictable, this volume is timely. The losses from the recent disruptions to education systems can be lessened if the world learns from them what has worked and what has not—and why. This volume brings together an excellent set of rigorously prepared chapters that will facilitate this learning."

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